FEB 14 1920

Subscription Price:
United States and Canada, $5.00 Per Year.
Great Britain, 21 Shillings; Single Copies, 3/6.
Foreign, $6.00 Per Year; Single Copies, 75 Cents.

VOLUME I FEBRUARY, 1920 NUMBER 10

THE JOURNAL OF INDUSTRIAL HYGIENE

AND ABSTRACT OF THE LITERATURE

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Industrial Diseases Under the Mediaeval Trade Guilds

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Notes upon an Unreported Cause of Occupational Dermatosis

Pneumokoniosis in Man and Horse

The Control of Infectious Diseases in Industrial Communities

Published Monthly at 1 Divinity Avenue, Cambridge Branch, Boston, Massachusetts
by The Macmillan Company
General Offices: 64–66 Fifth Avenue, New York City

Great Britain: Macmillan and Co., Ltd., St. Martin's Street, London, W.C. 2

Entered as second-class matter, at the Post Office at Boston, Mass., under Act of March 3, 1879. Published monthly.
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THE JOURNAL OF INDUSTRIAL HYGIENE

PUBLISHED MONTHLY

VOLUME I | FEBRUARY, 1920 | NUMBER 10

INDUSTRIAL DISEASES UNDER THE MEDIAEVAL TRADE GUILDS*

THOMAS M. LEGGE, M.D., D.P.H.

His Majesty's Medical Inspector of Factories and Workshops, Great Britain

THE last thing I should claim would be to be called an archaeologist. But this is not to say that I am not intensely interested in bygone times, and do not fervently admire the perfection of work wrought in stone, metal, wood and textiles under the totally different conditions of life, employment, and, shall I say, spirit, which prevailed in the Middle Ages. In England and in Scotland, to say nothing of the continent, one is brought up against what has been left of this life in almost every town and village — in cathedral, parish church, guild hall and country cottage, with all that they contain of craftsman's skill in the service both of God and man. Nowhere in Europe and at no time, scarcely, can one escape the feeling of bygone generations at work on materials of which they were the masters, adapting themselves with difficulty to changed circumstances, as conservative in their craft rules as they were free in their style and tastes; and living a corporate life under the guardianship of the municipalities, in guilds or fraternities which exercised a rigid supervision over the whole conduct of the individual.

Although this close monopoly which the trade guilds sought to maintain in each township, by limiting the number of apprentices, visiting with dire pains and penalties the "strangers", as they called those artificers who settled in towns in which they had not served their term, ultimately led to their undoing; yet before this happened, the system had served its time well — a time when communication of one country, nay, of one town with another was limited, when the desire to pile up money was not the aim and object of every right-minded man, and when capital did not spread its tentacles to and take toll of all the corners of the earth.

Living in a country which was the cradle of the guild system, in which that system was the living force of industry for 500 years, and in which one still tries to make believe that something of that spirit remains, I have sought at times to picture to myself the kind of life that was led, to visualize the craftsman at his work, and to sympathize with him in the industrial diseases from which he suffered; for, believe me, as I shall attempt to show you, he must have suffered from them far more than his prototype does to-day. With the object, then, of paying homage to our great forerunners in the game of life, of seeing what we can learn of them and their methods in industry that will profit us to-day and not with any idea, as you can well imagine, of trying to put the clock of the world back, I have prepared these two lectures.

In looking through the charters of guilds of no matter what craft, and from no matter what town or country, in the earliest, as well as the latest, you find stress almost invariably laid on three outstanding points:

1. Assistance to sick and poor members.
2. Honest work, as shown in their system of inspection or, as they called it, "searching."
3. Pride in their work, and in their guilds, as shown in their processions, their guild halls, and their contributions to chapels and chantries.

* Lowell Institute Lecture, delivered in Boston, Mass., Nov. 24, 1919. Received for publication Nov. 25, 1919.

So much is there to be said, that I will speak only of the first to-day, and of the second and third in my next lecture.

The craft guilds were the only friendly societies, benefit societies and sick societies, that existed in their times. Thus, in the charter granted by King Richard II to the Gild of the Peltyers (furriers) in Norwich, "it is ordeyned . . . yat quat broyer or syster, be goddis sonde, falle in mischefe or mys-ese, and have nout to helpen hemselfe, he schal han almesse of eueri broyer and syster euery woke, lastende his myschefe. . . . But if it be his foly, he schal nout han of ye elme." The last point, you see, shows that the early guilds were up against the same difficulty that the latest state insurance acts have been, namely, how far can an illness, wilfully or culpably brought on himself by a man, become matter for compensation. The Carpenter's Guild goes a little further, and tacks on "ryotous lyvyng" to "folye," as a reason for exclusion from benefit.

The Guild of the Smiths of Chesterfield draws a distinction between the treatment of the sick and of the poor because the ordinance says: "If any brother is sick and needs help, he shall have a halfpenny daily from the common fund of the gild, until he has got well. If any of them fall into poverty, they shall go, simply, on given days, to the houses of the brethren, where each shall be courteously received, and there shall be given to him, as if he were the master of the house, whatever he wants of meat, drink and clothing, and he shall have a halfpenny like those who are sick; and then he shall go home in the name of the Lord."

Respect for the dead, too, is solemnly enjoined by a procession of the members of the guild at the funeral, burial service, and by offerings at mass.

We have to think of the trade guilds as societies of workmen in one trade, of masters and apprentices under one elected warden, and officers who kept registers of members and minute books of expenses, delinquencies, fines, and transactions — the whole guild being bound by certain customs and ordinances. The system was largely founded on family life. The master was allowed to bring up his children in his trade, but he was only permitted to have one apprentice, who had to be formally inscribed, had to sign on for seven years during all of which time he had to live as one of the family in the house of his master, sharing his food and the family life. Hours of work were very long, from 5 o'clock in the morning in winter and 6 in summer to 7 at night, with perhaps three hours off for meal-times.

In the fifteenth century hours depended much on the amount of daylight, and varied, excluding meal-times, from seven to thirteen hours. Work by artificial light was often prohibited. The desire to shorten the working day showed itself early, and in some ordinances we find work forbidden on one half-day a week. Holidays were fixed by the church festivals of which there were plenty. In all there were 275 working days in the year. Work was forbidden on Sundays, on holy days, and on the evenings before them.

The apprentice had usually to be indoors by 9 o'clock at night. "Boys will be boys," and stern measures were often necessary to preserve quiet and peace in the streets, and to ensure that the apprentices went to bed betimes. The lot of the foster child is proverbially a hard one, and in many cases that of the apprentice, obliged to sleep anywhere and to be one of a family to which he did not belong, must have been irksome in the extreme. And his apprenticeship lasted for seven years, as a rule, after which, on performance of his *chef d' oeuvre*, testifying to his ability as a craftsman, he became worthy to be admitted, with all due forms and ceremonies, into the great fraternity of master craftsmen. With what longing must he have looked forward to that day, and with what pride must he have grasped, on his election, the hand of fellowship extended to him by the warden. Is there, in the early life of the workman to-day, anything so likely to mark such a red-letter day, or to make such an epoch in his career as this day of admission as a master craftsman, in the life of an apprentice in the time of the mediaeval guilds?

Now, while the modern factory system has changed industry very much, it has not, in the main, changed the materials used, except in industries dependent on our greatly advanced knowledge of chemistry. Some processes, especially during the last thirty years, have been made much safer, mainly through the application of locally applied ventilation, by means of fans for the removal of dust and fumes; others, no doubt, have been made much more dan-

gerous by the introduction of machinery and by the speeding up of that machinery, of which we constantly hear so much, by the size and scale of the operations and by the lifting tackle and means of transport required. These have brought about great changes in the life of industry, but not the greatest change of all. That change is a difference of taste and of appreciation of beauty; of this I shall speak more later. What concerns me to-night is to compare the healthiness of the processes as carried on in the two periods — in the time of the trade guilds, and in modern times.

If lead and mercury when used to-day cause illness, did not they do so five hundred years ago, when quicksilver certainly must have been used in the arts far more than it is to-day? And will not the same hold good of the work of the stone-mason, and the effect on his lungs of the sandstone dust; in that of the preparer of flax, with the extremely primitive methods by which this was done; in lead glazing of pottery, and in the making of armor?

Many sidelights are thrown on industrial diseases by writers of the Middle Ages. Does not the Chanoun's Yeoman of one of Chaucer's tales, in describing with minute detail the Alchemist's effort to find the Philosopher's Stone, say of his own experience:

> "Al that I hadde, I have y-lost ther-by;
> And god wot, so hath many mo than I.
> Ther I was wont to be right fresh and gay
> Of clothing and of other good array,
> Now may I were an hose upon myn heed;
> And wher my colour was bothe fresh and reed,
> Now is it wan and of a leden hewe;
> Who-so it useth, sore shal he rewe.
> And of my swink yet blered is myn ye."

But fortunately we do not have to rely on scattered references, because we have a complete work on the *Diseases of Artificers and Tradesmen*,* which was published in 1700 by Bernardino Ramazzini, then Professor of Medicine in Modena, and later in Padua. Ramazzini was, thus, collecting materials for his work about fifty years after William Harvey published his book on the *Circulation of the Blood* which, from the references he makes to the circulation, he must have known. Books on industrial diseases in those days seem to have sold like hot cakes — much better than they do now — for a second edition was soon called for, in which several additional chapters appeared. The value of Ramazzini's book lies in the fact that it was written just at the time of the parting of the ways in industry and medicine, when both were about to make greater strides in the next fifty years than they had done in the preceding five hundred years.

It was from members of craft guilds that Ramazzini derived his information, and he describes how he was obliged, in prosecution of his design, "to visit all the workhouses of Artificers, in order to get a clear view of the occasional causes of their diseases" because "the Shops or Workhouses of Tradesmen are the only Schools in which we can find any satisfactory knowledge of these matters." His book was translated into terse English as early as 1705 by that Dr. James, the friend and schoolfellow of Dr. Samuel Johnson, whose fame otherwise rests on his prescription for the well-known James's Powders, and it is from his version I quote.

What is the picture Ramazzini paints for us? Illuminating, certainly, if we read between the lines. In his preface he soundly observes — and I would preface my quotations from him by letting you know he calls a spade a spade and not an agricultural implement — that a doctor should not only ask his patient "What uneasiness he is under. . . . What was the cause of it. . . . How many days he has been ill. . . . How his belly stands. . . . What food he eats," but also "What trade he is of?" And, indeed, occupation is the most potent of all causes of incapacity.

In his preface, too, Ramazzini has a delightful reference to you which I cannot forbear quoting in spite of the warning in that incisive essay by Charles Russell Lowell, which every visitor to the United States from Europe should read, entitled *On a Certain Condescension in Foreigners:*

> "If we consider what a vast difference there is between the Europeans and the Americans, and other barbarous nations of the New World, we can't but be sensible that mechanik arts have contributed very much towards the civilising of mankind."

Shade of Ramazzini! If you could be here to-day, would you not recant somewhat of that sentence?

The book treats discursively in forty-

* No useful purpose would be served by republishing Ramazzini's book. I have, however, sought to quote the principal extracts which seem to me still to have a bearing on industrial hygiene to-day. Two copies of the volume are in the Surgeon General's Library, Washington, D.C.

three chapters of practically all trades and professions. Those that have most interest to us deal with metalliferous workers, chemists, glass-makers, potters, painters, dyers, tanners, bakers, millers, stone-masons, flax and silk workers. He spreads his net wide enough to include barbers and surgeons, nurses, Jews, porters, grooms, wrestlers, musicians, husbandmen, and learned men. He leaves out little except ship-building and the manufacture of high explosive shells.

The goldsmith's art was exercised, as you know, in the gilding of ornaments and images for church and home decoration; this was done on an unexampled scale by means of a gold-mercury amalgam. Mercury or quicksilver is one of the most powerful and subtle poisons, the use of

FIG. 1. — Goldsmiths' workshop, showing furnace on right. (*Fifteenth Century. From "Der Handwerker."*)

which, in industry, has now been much reduced, most fortunately, by the substitution of the nitrate of silver and ammonia process for it in the silvering of mirrors and by electro-plating. The old method — applying an amalgam of mercury and silver or mercury and gold — was very dangerous for the mercury had to be driven off by heat, thus exposing the worker to the inhalation of the noxious fumes. Occasionally, even now, one still finds silver and gold applied in the same old way, with attempt made to remove the fumes by a flue. And wherever metallic mercury is used, as in the making of clinical thermometers, still carried on in Clerkenwell very much as a home industry, the same evidence of the insidious absorption of mercury is found, showing itself clinically by tremulousness of the hands, inflammation of the gums with blackened and loosened teeth, and cadaverous complexion. Clinical signs do not change, and we can, therefore, picture to ourselves the condition and appearance of many a craftsman in the Middle Ages, who carried out and produced the decorative work we so much admire to-day, for in discussing the effect of minerals Ramazzini says:

"If we move from the Mines, and the Beating, Melting, and Refining Work-Houses, to the Cities themselves, even there we'll meet with Workmen that suffer by the influence of Minerals. 'Tis well known what dismal Plagues are inflicted by Quick-silver upon Goldsmiths, and chiefly those who are imployed in Gilding Silver or Brass Work; For as this Gilding can't be performed without Amalgamation (i. e., the Corrosion of the Mettal by Mercury), so when they afterwards come to dislodge this Mercury by Fire, tho they turn away their Faces, they can't possibly avoid the receiving some poysonous Steams at the Mouth, and accordingly we find that this sort of Workmen do quickly become Asthmatick, Paralytick and liable to Vertigo's; and their complexion assumes a dangerous Ghostly Aspect. Few such Workmen continue in that way to old Age; or if they do not die betimes, their Condition becomes so miserable, that Death is all their wishes. Their Neck and Hands tremble, their Teeth fall out, their Legs are weak and maul'd with the Scurvy. . . . I had Occasion my selfe not long ago to see a young Man, a Gilder, that dy'd after two Months confinement to his Bed; having taken too little care to avoid the Mercurial Exhalations. For they threw him at first into a Cachectick Habit of Body; after that his face became wan and of a Carrion complexion, his Eyes swell'd, his Breathing became difficult, and his Mind stupid, and an inactive lazy Drowsyness seiz'd his whole Body. He had fetid stinking Ulcers in his Mouth, which voided incessantly a very great quantity of ugly nasty Matter."

Ramazzini's explanation of the way in which mercury is absorbed and acts is sound, although expressed strangely to our modern ears.

"The Texture and Fabrick of the Quick-Silver being dissolv'd by the violence of the Fire, 'tis reduced to such minute Particles, as penetrate to the Lungs, Heart and Brain, upon their being receiv'd at Mouth and Nostrils. By this means 'tis inabled to cloud the animal Spirits with more Facility, and strike the whole Mass of Fluids with a narcotick Dullness."

Of another industry as ancient as any — pottery — Ramazzini describes the processes very much as they are carried on to-day. Thus:

"There 's scarce any City in which there are not other Workmen, besides those mention'd above, who receive great prejudice from the Metallick Plagues.

Among such we reckon the Potters; for what City, what town is without such as practise that the Ancientest of all Arts? Now, the Potters make use of burnt and calcin'd Lead for glazing their Ware; and for that end grind their Lead in Marble Vessels, by turning about a long Piece of Wood hung from the Roof, with a square Stone fasten'd to it at the other end. While they do this, as well as when with a pair of Tongs they daub their Vessels over with melted Lead before they put 'em into the Furnace; they receive by the Mouth and Nostrils and all the Pores of the Body all the virulent Parts of the Lead thus melted in Water and dissolv'd and thereupon are seiz'd with heavy Disorders. For first of all their Hands begin to shake and tremble, soon after they become Paralytick, Lethargick, Splenetick, Cachectick and Toothless; and in fine, you'll scarce see a Potter that has not a leaden Death-like Complexion. In the *Acta Haffniensia* an Account is given of a Potter in whose dissected Corps the right Lobe of the Lungs was found grown to the Ribs and tending to a wither'd dryness and a Phthisick; this Indisposition of his Lungs being attributed to the Trade he had work'd at; for the Patient had been bred to the Potter's Trade, and finding it unhealthful had left it off, tho not time enough."

In this brief description, Ramazzini gives the salient symptoms of the double danger of the potter's work — lead poisoning, showing itself in paralysis, and "potter's rot", in fibroid phthisis. He is quite clear in his distinction between the different processes, and tries to bring this out by saying:

"I could not forbear joining Admiration to my Curiosity, when the Enquiry how it came to pass that Earthen Ware first boil'd in the Furnace, then cover'd with Lead calcin'd, pounded with the Powder of Flints and melted, and thus put into the Furnace again, did assume by the influence of the Fire, that Glassy Crust that renders them so serviceable in all the uses of Life."

"In the mean time we must take Notice, that there are several different sorts of Workmen in a Potters Workhouse; some of whom are imployed in Working of Chalk with their Hands and Feet; and others in forming the Vessels by Sitting and Turning a Wheel. So that all who go by the Name of Potters are not subject to the Diseases before-mention'd, and therefore care must be taken that when ever the Name of a Potter is heard, we do not presently administer the Remedies calculated to correct the injuries of the Mineral Matter. However, this may be said of 'em all in General, that as they all spend their Lives in moist Places, and are still imploy'd in Handling moist Earth, so they are for the most part wan Complexion'd and Cachectick, and a'most always complaining of some illness or other. Those who sit at the Wheel and form the Vessels by turning it about with their Feet, are apt to have a swimming in the Head, if their Eyes are otherwise weak; and oftentimes the over tyring of their Feet makes 'em subject to the Sciatica; and therefore we ought to assist 'em with the Remedies prescrib'd by Practitioners in such Cases; which if they do not extirpate, will at least soften and mitigate the Disease."

Ramazzini gives us an insight into the risks of painting in passages full of chatty gossip and a banal philosophy, culled from old writers to whom he paid extraordinary deference.

"Painters are also usually subject to various Disorders, such as the Tremblings of the Joynts, a Cachexy, a Blackness of the Teeth, a discolour'd Complexion, Melancholy and loss of Smelling: For it seldom happens that the painters who use to draw the Pictures of others handsomer and better Complexion'd than the Originals, are themselves either handsome or well Complexion'd. For my part I have always observ'd that all the Painters I know either in this or other Towns, are a'most always

FIG. 2. — Polishing armor, showing curtain to protect against sparks and dust. (*Sixteenth century. From "Der Handwerker."*)

sickly; and if we consult the Histories of Painters, we'll find they were not long-liv'd; especially if we confine our view to such as made a distinguishing Figure. History informs us that Raphael Urbinus, a very famous Painter, was snatch'd away in the very Flower of his Age; and Balthasar Castilioneus condol'd his untimely Death in a very pretty Poem. 'Tis true, the Diseases of this sort of men may be imputed to their sedentary Life, and the Melancholy that feeds upon 'em, while they retire from human Society and bend all their thoughts upon their Phantastick Idea's. But the principal Cause of their Sicklyness is the Matter of the Colours that 's always among their Hands, and under their Nose; I mean the Red Lead, Cinnabar, Ceruss, Varnish, Oil of Wallnuts, and Oil of Linseed, with which they temper their Colours, and several other Paints made of various Minerals. Hence 'tis that their Shops have such a nasty stinking Smell, which is chiefly owing to the Varnish and foresaid Oils, and is very offensive to the Head; and perhaps the loss of Smell usual among Painters flows from no other Cause. Be-

sides, when the Painters are about their Work, they have nasty daub'd Cloaths upon 'em, that they can't avoid taking in at Mouth and Nostrils the offensive Exhalations: which, by invading the Seat of the Animal Spirits, and accompanying the Spirits to the Blood, disturb the economy of the natural Functions, and give rise to the above-mention'd Disorders."

No more graphic description of the worst form lead poisoning can take could be given than the description which Ramazzini quotes of an Anjou painter who

"was seized at first with a Shaking and Trembling in his Fingers and Hands, and afterwards with Convulsions in the same Parts, which likewise affected the whole Arm. Sometime after, the same Symptoms appeared in his Feet, and at last he was taken with such a grievous Pain in his Stomach and both the Hypochondria, that neither Glysters, Fomentations, Baths, nor any sort of Remedy gave him ease. The only relief he had in the violence of the Fits, was to have three or four Men, leaning with all their Weight upon his Belly, the Compression of which lessen'd the Torment. In this miserable Condition he continued for three years, and then dy'd Consumptive."

Of this case, too, he adds the true observation about the findings of post mortem in cases of acute plumbism, that "there was nothing preternatural to be seen about the Viscera"; and he commends the honesty of the narrator who frankly confessed "All of us mistook the Case, and were quite out of the Way."

House painters and coach painters are still to-day the greatest sufferers from lead poisoning. Seeing that locally applied exhaust ventilation is impracticable for their work, there can be only one way in which the poisoning can be stopped, and that is by the substitution of zinc oxide for lead paints.

I have spoken of Ramazzini's chattiness. Here is an anecdote he gives about Corregio:

"The same is the Cause of their discolour'd Complexions, and Cachectick Habit of Body; as well as of the Melancholick Fits they are usually Subject to. 'Tis said of Antonius de Allegris, commonly called Cro Corrigiensis from Corregio the Place of his Nativity, that he was so melancholy and even stupid, that he had no Sense of the Value and Excellency either of himself or his Pieces; insomuch that he returned to his Admirers the rewards they sent him, as if they had been mistaken in giving a great Price for those Pictures which are now above any Price whatsoever."

Turning now to another great group of craftsmen of the Middle Ages, to whom we owe so much of the finer pleasure of life — the stone-hewers, stone-cutters, and statuaries — Ramazzini says "they oftentimes suck in, by inspiration, the sharp, rough and corner'd small Splinters or Particles that fly off; so that they are usually troubled with a cough, and some of 'em turn Asthmatick and Consumptive." And he goes on:

"And in dissecting the Corps of such Artificers, the Lungs have been found stuffed with little Stones. Diemerbroek gives a curious Relation of several Stone-cutters that dy'd Asthmatick, and were open'd by him; in whose Lungs he found such heaps of Sand, that in running the Knife thro' the Pulmonary Vesicles, he thought he was cutting some Sandy Body. He adds, that he was inform'd by a Master Stone-cutter, that in cutting Stones there rises such a subtile Dust, as is able to penetrate thro' Ox Bladders hung in the Shop, insomuch that in the space of one Year he found a handful of that Dust in the Cavity of the Bladder: And this very Dust he took to be the cause of the Death of many unwary Workmen."

How interested Ramazzini would have been to know that not all stones make the lungs cut, as he puts it, "like some sandy body," but only sandstones, gritstones, and the like, which contain large amounts of free silica or flinty matter, as my late colleague, Dr. Collis, has recently shown. And would he not have been interested to know that last year (1918), in the gold mines of the Transvaal, hundreds of thousands of pounds were given out in compensation for this condition of "flint on the lung," and that its detection occupied the whole time of six physicians?

Those who grind plaster in hand-mills and sift it, and manipulate the fine plaster into "various Pieces especially Images and Effigies for the Adorning of Churches, great Halls and Libraries," he has frequently observed "usually labour under a difficulty of Breathing . . . and their Faces are discolour'd and truly pargeted."

Here, and in all his references to respirators, Ramazzini is very sensible, for he recognizes that workmen cannot wear them for any length of time.

"Tho such Workmen have a Cover for their Mouth, they can't avoid receiving the flying particles of the Parget at Mouth and Nose; upon which these Particles enter the Passages of Respiration, and mixing with the Lymph, rise up in hard chalky

concretions, or by daubing the winding Passages of the Lungs intercept the Freedom of Breathing."

Again in discussing the preventive measures possible for bakers, he says:

"In the first place those who boult the Flower and cleanse it from the Bran, and are always shaking and turning the Sacks and Bags, cannot possibly so cover their face as to avoid the Inspiration of the flying particles of the Meal, together with the Air; and these being fermented with the Salivary Juice, stuff up not only the Throat, but the Stomach and the Lungs with a tough paste; by which means they become liable to Coughs, Shortness of Breath, Hoarsness, and at last to Asthmas; the wind Pipe and the Passages in the Lungs being lined with a Crust that interrupts the Intercourse of the Air. Further, the particles of the Flower or Meal that stick to the Eyes, pinch 'em very much, and oftentimes occasion a Blear'dness.

"I freely own, I can't think of any effectual Preservatory caution for these Workmen. I approve of the custom they have of tying a Linnen Swathe round their Face, but all that will not hinder the Atoms of the Flower to invade the Breast along with the Air."

And yet again, of the sifters of corn and grain:

"The Workmen employed in these services use to cover their Mouth and Nostrils with Handkerchiefs, to keep out the Dust, and to wash their Throat and Eyes often with cold Water; but all this Caution is not sufficient to indemnify them."

He describes industrial eczema, that bugbear of so many workers, who are exposed to dust and liquid. Bakers' hands, he says, are sometimes "swell'd and pain'd." "And indeed 'tis observable, that all of 'em have very large thick hands. . . . So that Bakers quickly discover their Trade, when they shew their Hands, for no Handicraftsmen have larger Hands than they."

And of washerwomen he says, "The sharpness of Lye exposes them to Chops in their Hands, which are sometimes so deep and troublesome, as to be followed with an Inflammation and a Feaver."

He refers also to the carrying of heavy weights as a cause of hernia among millers, from the bearing of sacks of corn or meal on their shoulders.

Where Ramazzini seems to get hold of the wrong end of the stick is in attributing all manner of diseases, "shortness of breath, headaches, megrims, and cachexies" to noisome smells and exhalations. In mediaeval times, what we speak of as offensive businesses — candle-making, gut-scraping, tanning, and the like — must have been carried on with little regard to the susceptibilities of the neighbourhood. Ramazzini confirms what we find stated in certain guild ordinances that offensive callings, like tanning, had to be exercised in the suburbs in places allotted to them. What these smells must have been like may be gathered from his description of the effect of the dressing of hides:

"I have oftentimes observ'd, that neither spurring nor whipping would make some Horses pass by such Places, but as soon as ever they smelt 'em, they turn'd about, and without any regard to the Bridle, run directly home, as if they had been mad. The Houses in which these Hides are dress'd, are plac'd either near the Walls of Cities, or without the Walls, as in this city of Modena, to prevent the infecting of the Air."

Ramazzini is quite wrong in attributing illness from their trades to those, such as the makers of catgut, who did certainly require welfare arrangements, such as washing accommodation, first aid, overalls, and mess room, but were not, as he says they were, "wan in the face, and cachectic." What can have been the composition of the tallow candles from which a certain John contracted "a grievous Disorder in his Lungs and his Brain," as he pursued his studies by their light? Still more surprising are the passages stating that lime wash (on walls) is the cause of acute fever and ill distemper, even six months after it has been applied. He must mistake cause and effect, for the condition which led to the need of the lime washing was no doubt the cause. With his belief, what would he have said to the requirement of the English Factory and Workshop Act that every room shall be lime-washed at least once every fourteen months?

This subject brings us to the suggestion made by Ramazzini in regard to welfare and preventive measures. As to hours, he expresses himself most interestingly on night baking, a subject which has come into prominence this year in England. Bakers are, he says:

"Exposed to infinite Fatigue and Toyl, and so brought under the lash of various Diseases. Bakers are generally at work in the night time, whilst others, having finished the Task of the Day are recruiting their Spirits with seasonable sleep; and then in the Day time they are shut up like Owls to take their rest."

He advises the washerwomen:

"As soon as their Work is over, to throw off their wet things, and put on dry Cloaths; in which point they are generally very careless: I advise 'em likewise to use Frictions; to turn away their Faces as much as they can from the Smoak of the hot Lye; to anoint their Hands with Oyntment of Roses or Butter; to abstain from gross Food; and to observe a regular Diet."

On the subject of baths he has some interesting observations which reflect on the gross manners of the times.

"In the Days of Antiquity, especially at Rome where there were so many Baths for publick Use, Workmen of sordid Trades receiv'd considerable Benefit by washing off the Impurities contracted in their way of Business, and retrieving their Strength, in Baths, as Baccius de Thermis well observes. But now-a-days those excellent Provisions are sunk, and so the City Tradesmen are depriv'd of a singular Benefit. To make up this Loss, when they go to Bed, let 'em endeavour to wipe off the foul Matter that hinders Perspiration, and correct the noysome smell that haunts 'em, by washing and rubbing their Bodies with a Sponge dip'd in hot Muscadine Wine: and by way of precaution, upon all holy Days, I would advise 'em to wash themselves at home in sweet water, and walk abroad in clean Linnen. For 'tis not to be imagin'd how much the Animal Spirits are Exhilarated by cloathing the Body with clean Things: and for that reason I can't decry enough that vulgar opinion which even some Physicians entertain, that sick people must not shift their Shirts or Sheets for Fear of becoming thereby weaker. . . . We conclude therefore, that we cannot too much recommend to Fullers and all others that live by Sordid, Slovenly Trades, the frequent shifting of their Linnen, and keeping their Body clean; that by that means they may prevent, as far as it's possible, the Diseases that flow from Filth and Nastiness."

And again, in recommending baths in the dusty work of corn sifting, he feels regretfully that his advice must fall on deaf ears.

"Questionless it would be convenient for 'em to use Baths, to wash off the dusty Filth that sticks in the Skin along with the Sweat; but now that Baths are in disuse, the poor Workmen are depriv'd of that Benefit: For we must not think that these Ancient Builders of Cities and Compilers of Laws, were at all that Charge and Magnificence of Building, not only in great Cities, but even in lesser Towns, in making publick Baths only to gratify the Luxury and Softness of Women and idle Fellows, but likewise for the sake of Tradesmen and hard Workers, that they might have an opportunity of washing off the Filth of their Bodies, and refreshing their weary Limbs at a small Charge. Upon this Consideration we have reason to curse those that brought so noble a Constitution into Dis-reputation; and by their open Iniquity in promiscuous Baths, provoked the Christian Piety to suppress them."

Of the textile industries—heckling, carding, spinning, and weaving of flax and hemp—the workers in which he describes as "daub'd over with Hemp Dust, pale Fac'd, subject to Coughs, Asthmatick and Bleerey'd," Ramazzini adds:

"The Winter being the Season allotted for that Work, they are obliged to work in close Places; and considering that the Hemp is very Greesy and Oyly, upon that occasion they cannot but take in at the Mouth these foul Particles that pollute the Spirits, and stuff up the Organs of Respiration. Add to all this, that the Hemp and Flax being steep'd in stagnating and putrid Water, and dawb'd over with Clay to promote its readier maceration under the Water, the Particles thus imbibed cannot but be virulent and open enemies to human Nature."

Ramazzini notes the same fact that I have myself found that:

"These work-People complain that they suffer more in Hatcheling of Flax than in Hemp; and that,

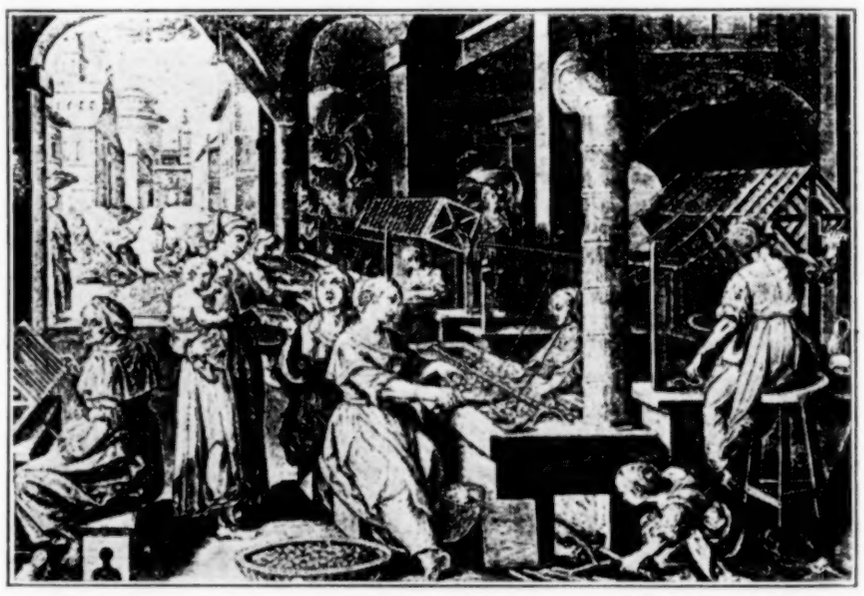

FIG. 3. — Winding silk from cocoons. (*Seventeenth Century. From "Guilds of Florence" by Edgcombe Staley.*)

perhaps, because the Powder or Dust of the former is subtiler, and so making a smarter irruption into the Organs of Respiration, provokes 'em more sensibly to throw off the clog that galls 'em."

And I remember, twenty years ago, in an inquiry into the health of silk spinners, having occasion to bear witness to the accurate description he gives of the unpleasant nature of the dust inhaled in the early processes of silk spinning:

"But worst of all is the Condition of those who comb the Silk Cakes that remain after the making of the Silk, in order to spin it into Thread for several Uses, as being less chargeable than the Silk it self. For when the Bags of the Silkworms, after being

steep'd in hot Water, are open'd and untangl'd by our Women, (that being the peculiar Province of the Women, as if Nature had provided Silk only for their Use) and wound upon Reels in small Threads, there are still some grosser Threads or Filaments behind, which have part of the Bodies of the Silkworms mixed with 'em; and of these they make a sort of Cakes, which they dry in the Sun, and give out to Workmen to have 'em drawn out into Threads with small Combs. Now the poor People that comb these Cakes are usually troubled with a vehement Cough, and a great Difficulty of Breathing, and few of 'em live to old Age in that way of Business. The Virulence that gives Rise to this Tragedy is owing to the cadaverous Particles of the Silkworms that are mix'd with the Cakes."

What could be a better motto for any manufacturer to lay to heart than the sentence with which Ramazzini closes this chapter: "'Tis a sordid Profit that's accompany'd with the Destruction of Health."

THE MORTALITY OF BITUMINOUS COAL MINERS FROM INFLUENZA–PNEUMONIA, OCTOBER TO DECEMBER, 1918*

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BITUMINOUS coal miners apparently suffered very severely from the influenza epidemic in the last quarter of 1918. Figures of mortality are available for a total of 4,700 miners insured in the Group Department of the Metropolitan Life Insurance Company during the period of the epidemic. The areas included a considerable number of mines in West Virginia and Pennsylvania.

In all, sixty-four deaths occurred among these coal miners from either influenza or pneumonia during the three months under investigation. This is equivalent to an annual death rate of 50 per 1,000. In other words, 5 per cent. of the miners would have died if the influenza epidemic had prevailed with the same severity over the entire year as in the last quarter. Among all occupied males, aged 15 years and over, the rate from influenza-pneumonia in the same three months was 22 per 1,000 or less than half as high.

The above figures are for all ages. But, at the age period 25 to 45, the rate was 62 per 1,000 living and at 45 to 65 years, 44 deaths per 1,000. In every instance, these figures are higher than any found in the entire industrial experience of the company for white males at the corresponding ages. In fact, in the age period 45 to 65 years, the rate among bituminous coal miners is close to four times as high as among all occupied males.

Coal miners ordinarily suffer severely from the respiratory diseases. During the epidemic, there was no exception to the rule.

The following table presents the death rates by age period among bituminous coal miners in comparison with those for all occupied white males:

INFLUENZA-PNEUMONIA MORTALITY AMONG BITUMINOUS COAL MINERS

October to December, 1918, Compared with All Occupied White Males, Industrial Department, Metropolitan Life Insurance Company

Age Period	Annual Death Rate per 1000	
	Bituminous Coal Miners	All Industrial White Males
All Ages†	50.1	22.3
15–25	29.5	17.5
25–45	62.1	32.6
45–65	44.4	11.7

* Received for publication Dec. 19, 1919.

† Fifteen years and over.

INFLUENZA IN THE EASTERN GROUP OF TELEPHONE COMPANIES, BELL SYSTEM, 1918 *

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INFLUENZA is endemic in certain parts of eastern Europe. In a recent address, Flexner fixes its habitat in the border region between Russia and Turkestan. "Similarly, there are excellent reasons for regarding the endemic home of influenza to be eastern Europe, and in particular the border region between Russia and Turkestan. Many recorded epidemics have been shown more or less clearly to emanate from that area, while the epidemics of recent history have been traced there with a high degree of conclusiveness."

The disease is not a new one, though given the name of Spanish influenza last year. The first authentic epidemic in modern times, according to Craig and Dublin, was in 1510. The most recent epidemic prior to the one of 1918 was in 1891, which followed closely upon the epidemic of 1890. The epidemic of last year had its origin in its endemic home above referred to, whence it swept eastward and westward along the lines of travel. It appeared early in Germany and then in Spain. From the latter country it travelled into France and was for that reason called Spanish influenza by the French. The epidemic next appeared in pandemic form in Great Britain, and then along the Atlantic Coast of the United States, from whence it swept westward to the Pacific. While the primary phase of the epidemic in the United States has been thought to have been the pandemic sweep of 1918, the opinion has recently been expressed that the primary phase was really during the spring of 1918 and that the big sweep of October was the secondary phase. The statistics of the Eastern Group of Telephone Companies of the Bell System uphold this view.

The bacteriology of influenza is still unsettled. Numerous studies made by the world's most competent bacteriologists have failed to prove that the bacillus of Pfeiffer is the exciting organism, though frequently associated with the disease.

Influenza swept over the territory served by the Eastern Group of Telephone Companies in the fall of 1918 in pandemic form. During the crest of the epidemic, the telephone service was severely embarrassed by reason of the large number of cases among the employees, whose ranks had already been depleted by the call to arms and to other war activities. The increase of illness among the general population also added a heavy burden to the work of the telephone companies because of the increased number of calls for physicians, nurses, and druggists, and the increased amount of general business transacted by telephone. These last factors are peculiar to the telephone industry because epidemics, which incapacitate the employees, at the same time increase the amount of service demanded by the public. To safeguard the health of the telephone employees during such epidemics is therefore of the greatest importance not only for their personal benefit, but in order that the companies may continue to give the public adequate service.

It was with a view to determining how best the medical departments could assist in accomplishing the desired result, that the present study of the influenza epidemic was undertaken. Inasmuch as the chief function of the medical departments is to prevent illness among employees of the companies — the treatment of illness when it occurs being left to their private physicians — symptomatology, pathology or treatment are not dealt with in this study.

Great difficulty was encountered in securing adequate statistics because at the present time there are no illness records of all employees of the companies. The only statistics available were those of employees who were eligible for benefit under the Employees' Benefit Fund plan.

This study has special significance, be-

* Received for publication Nov. 13, 1919.

TABLE 1.—ESTIMATED NUMBER OF EMPLOYEES (BOTH SEXES) IN EACH AGE GROUP ELIGIBLE FOR BENEFITS UNDER EMPLOYEES' BENEFIT FUND PLAN, 1918

Company	Total	16 to 19	20 to 24	25 to 34	35 to 44	45 to 54	55 to 64	65 & over
New York Telephone Co.	19,999	1,094	6,550	7,383	3,582	1,033	306	51
Bell of Pennsylvania	8,769	92	3,043	3,392	1,577	477	156	32
Chesapeake and Potomac	4,449	165	1,329	1,683	817	320	118	17
Eastern Group	33,217	1,351	10,922	12,458	5,976	1,830	580	100

cause it deals not only with the mortality of influenza, but also with its morbidity in contradistinction to the surveys of health departments and insurance companies which ordinarily deal only with mortality.

As has been said, the only statistics available were those of employees who were eligible for benefit under the benefit fund plan. Consequently, a large group of employees — to wit, those who have been in the companies' employ for less than two years — were not included, nor were those cases of illness among employees eligible for benefits where the duration of illness was less than one week. This last factor would seem to lessen the value of the statistics submitted but, on second thought, it will be realized that, while some cases of influenza may have escaped, all those minor cases of colds which might have been diagnosed as influenza have been eliminated.

Personnel

The number of employees eligible for benefit under the plan in 1918 could not be accurately determined, but the statistical office of the American Telephone and Telegraph Company furnished estimates of the number of employees at each year of age, which were then combined into ten-year period groups between 25 and 65 years of age. Under 25 years the number of employees was divided into two groups, one consisting of those from 16 to 19 years, inclusive; the other, of those from 20 to 24 years, inclusive. All over 65 years of age were grouped in one class. It can be gleaned from Tables 1 and 2 that the employees of the telephone companies were, for the most part, at the ages that suffered most severely during the past epidemic of influenza and that the average age of the female employees was lower than that of the male employees.

Morbidity

Tables 3 and 4 contain the number of cases of illness caused by influenza, bronchitis and pneumonia among employees eligible for benefit under the plan during the year 1918. In Table 4 the cases have been separated by sex as well as by age, while in Table 3 they have been separated only by age and company.

The highest case rate was among the group 16 to 19 years, but the employees at these ages were few, and in one company the number of cases among them exceeded the number exposed, due to the fact that several persons were reported as ill twice in the same year from influenza or pneumonia. The next highest rate was encountered in the group between 20 and 24 years. From that period the rate gradually

TABLE 2.—ESTIMATED NUMBER OF EMPLOYEES ELIGIBLE FOR BENEFITS UNDER EMPLOYEES' BENEFIT FUND PLAN IN 1918, SEGREGATED BY SEX, AGE AND COMPANY

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
New York Telephone Co.	145	949	643	5907	3726	3657	3017	565	882	151	268	38	48	3	8,729	11,270
Bell of Pennsylvania	27	65	288	2755	1599	1793	1186	391	366	111	106	50	24	8	3,596	5,173
Chesapeake and Potomac	25	140	227	1102	916	767	660	157	269	51	103	15	13	4	2,213	2,236
Total Eastern Group	197	1154	1158	9764	6241	6217	4863	1113	1517	313	477	103	85	15	14,538	18,679

diminished until the group 65 years and over was reached, when the rate rose slightly again, but the number of persons here exposed was too small to justify any conclusions being based upon this partic-

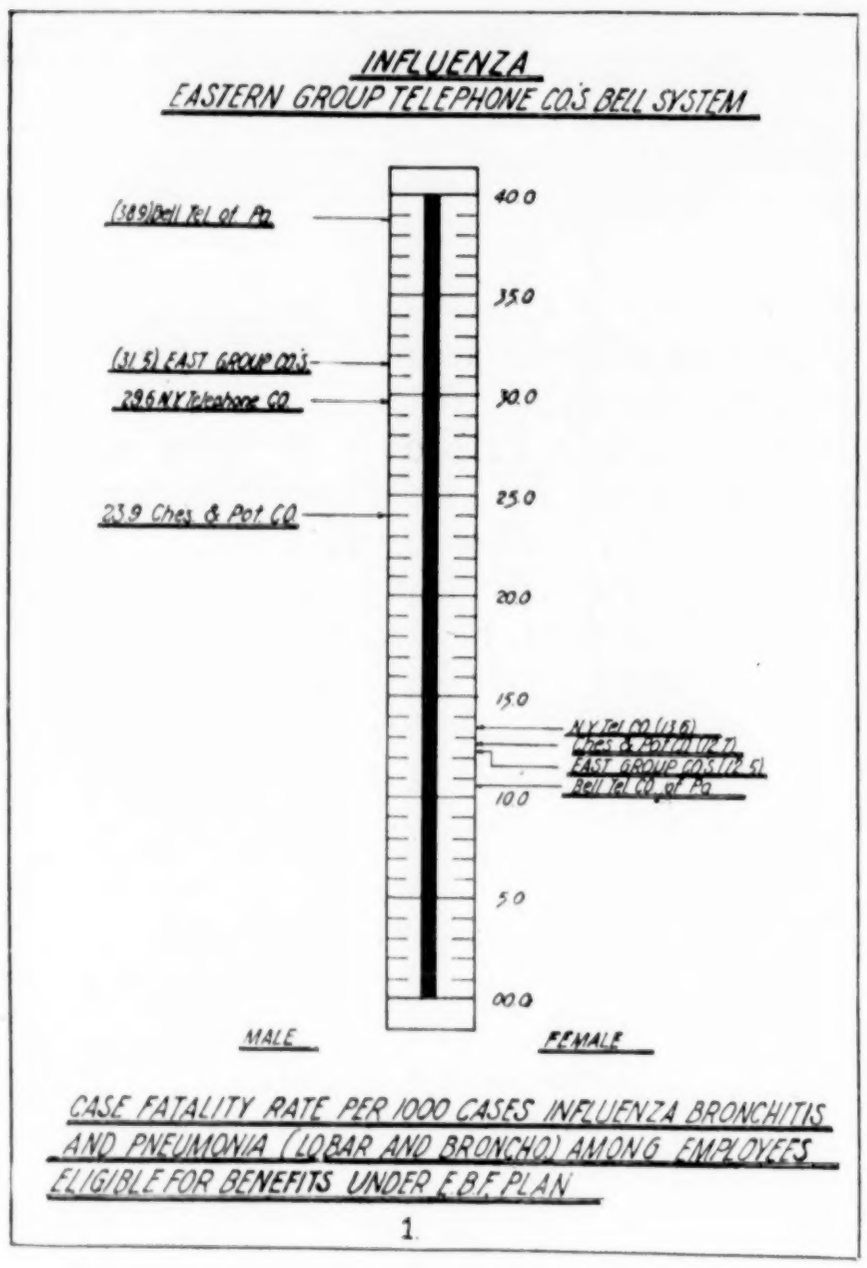

FIGURE 1.

ular rate. In Table 5 the rate of illness per 1000 employees in each age group is shown. While here again the data were not of sufficient volume to justify sweeping deductions being based on individual rates, certain general conclusions may be drawn from the statistics presented in this table when considered collectively. In every company the incidence of the epidemic was lower among the males than among the females, being 135 per 1000 against 254 per 1000 in the New York Company; 193 against 328 in the Bell of Pennsylvania; 170 against 245 in the Chesapeake and Potomac Telephone Company and 155 against 274 in the Eastern Group. Furthermore, this less favorable incidence among females is apparent at each age group up to and including the age group 45 to 54 years, inclusive. After that, there is a higher incidence among the males than among the females. This, however, may well be due to the paucity of data at the older ages, especially among the female employees.

FATALITY

Proportion of Deaths to Cases

In general, it may be said that the incidence of the epidemic was greater among the female employees than among the male employees, but on the other hand the fatality of the epidemic was greater *pro rata* among the males than among the females. For the Eastern Group, the case fatality was 31.5 for the males as compared with 12.5 for the females. (Table 12.) The number of cases and the number of deaths were so small that it hardly justified the computation of rates for each age group of males and females; however, the consistently higher case fatality rate of males as compared with females warrants the conclusion that, while there were fewer cases among the males, their fatality was far in excess of the females. Craig and Dublin in their analysis of the mortality among the policy holders of the Metropolitan Life Insurance Company encountered and called attention to the higher mortality among the males than among the females. The statistics of the Eastern Group of

TABLE 3.—NUMBER OF CASES OF INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO) DURING 1918 AND RATES PER 1000 ELIGIBLE EMPLOYEES IN EACH AGE PERIOD

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
New York Telephone Co.	421	385	1622	247	1433	194	430	116	107	103	25	82	9	176	4047	202
Bell of Pennsylvania	77	830	1088	357	899	265	240	152	64	134	20	128	4	125	2392	273
Chesapeake and Potomac	57	345	312	235	351	208	143	175	41	128	17	144	2	117	925	208
Eastern Group	555	411	3022	277	2683	215	813	136	214	117	62	107	15	150	7364	222

Telephone Companies would indicate that this higher mortality among the males than among the females was not due to a higher morbidity among the males as compared with the females, but to a higher case fatality. This was probably due to the fact that the initial symptoms of influenza are often slight, with the result that robust persons are apt to disregard them and not take to bed. It was, however, among these neglected cases that the worst complications were encountered, so that it may be concluded that the men who did not promptly recover from their early symptoms, when compelled to report sick, had a poorer chance of recovery than did those who took the disease in hand early. This point will be dwelt upon in the recommendations.

It is interesting to note that the highest illness rate of influenza and associated causes was among the employees of the Bell Telephone Company of Pennsylvania. The illness rate for this company was 273 per 1000 employees as compared with 202 per 1000 employees of the New York Telephone Company, and 208 per 1000 of the Chesapeake and Potomac employees. These rates correspond to the observation of the health authorities in the districts covered by these companies, Philadelphia having a higher rate than either New York or Baltimore. The incidence rate for the entire Eastern Group was 222 per 1000 employees eligible for benefits under the plan.

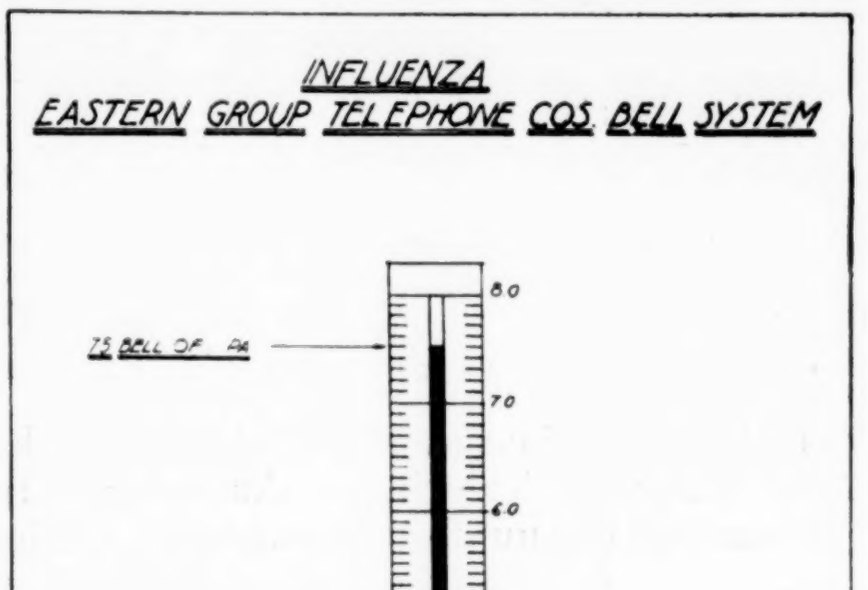

FIGURE 2.

SEASONAL OCCURRENCES

In Table 6 the number of cases of influenza have been arranged according to month of onset and confirm the very interesting fact that the first phase of the epidemic occurred in March and that the pandemic of October was really the second phase. In every company of the Eastern Group, the number of cases rose above the normal incidence in March, thereafter declining steadily until August. In September the incidence curve began to rise again, and in October reached its maximum when almost 4000 cases were reported in the Eastern Group among employees eligible for benefits. More than 2100 occurred in the New York Company, more than 1200 in the Bell Telephone Company of Penn-

TABLE 4. — NUMBER OF CASES OF ILLNESS CAUSED BY INFLUENZA, BRONCHITIS, PNEUMONIA (LOBAR AND BRONCHO) AMONG EMPLOYEES ELIGIBLE FOR BENEFIT UNDER EMPLOYEES' BENEFIT FUND PLAN DURING YEAR 1918

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
New York Telephone Co.	27	394	87	1535	589	844	356	74	90	17	23	2	9	0	1181	2866
Bell of Pennsylvania	6	71	65	1023	379	520	178	62	45	19	17	3	4	0	694	1698
Chesapeake and Potomac	6	51	29	283	169	182	114	29	39	4	17	0	2	0	376	549
Total Eastern Group	39	516	181	2841	1137	1546	648	165	174	40	57	5	15	0	2251	5113

TABLE 5. — RATES OF ILLNESS CAUSED BY INFLUENZA, BRONCHITIS AND PNEUMONIA, DURING 1918 PER 1000 EMPLOYEES ELIGIBLE FOR BENEFITS UNDER THE EMPLOYEES' BENEFIT FUND PLAN

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
New York Telephone Co.	186	415	135	260	158	231	118	131	102	112	86	53	187	0	135	254
Bell of Pennsylvania	222	1092	225	371	237	290	150	158	123	171	160	60	166	0	193	328
Chesapeake and Potomac	240	364	127	251	184	237	173	184	145	78	165	0	154	0	170	245
Eastern Group	198	447	156	291	182	248	133	148	115	128	119	49	176	0	155	274

sylvania and almost 500 in the Chesapeake and Potomac Telephone Company. In November the number of cases fell, to rise again slightly in December. No statistics for the early months of 1919 are available at this time. A monthly case rate, computed upon the data contained in Table 6, confirms the rise above normal in March, the decline until September and the tremendous increase in October, a temporary decline in November and a final rise in December.

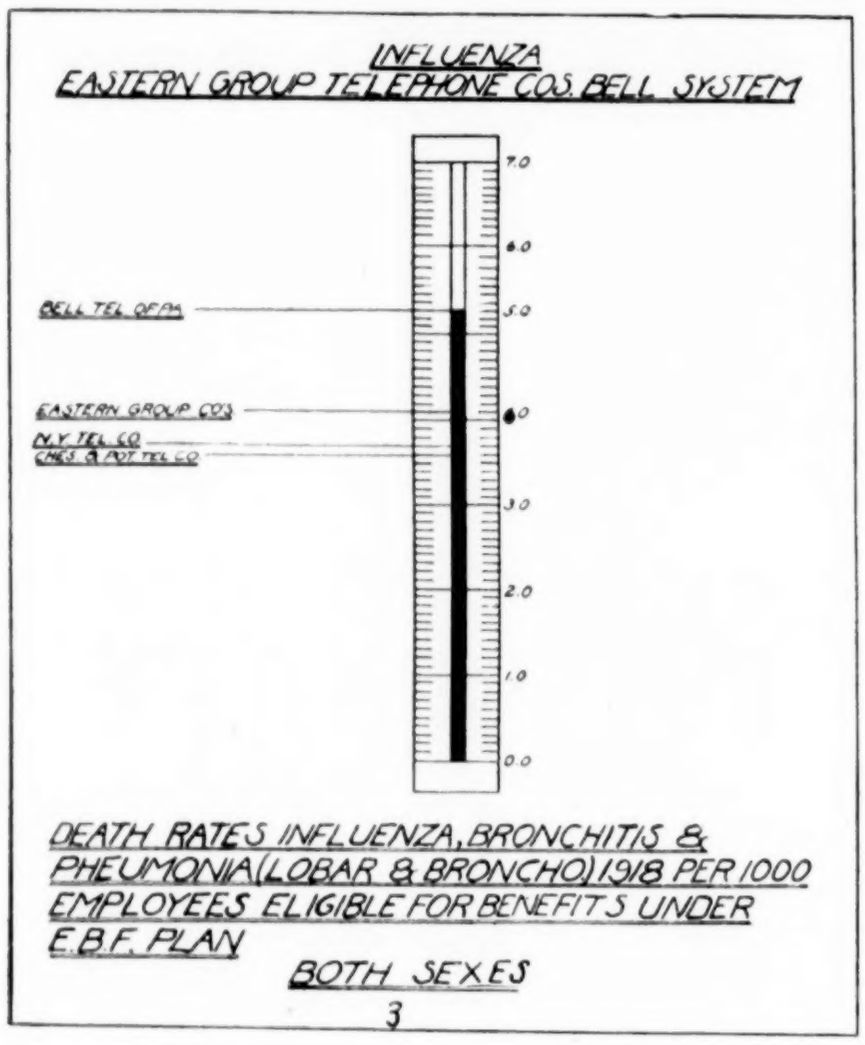

FIGURE 3.

During the first phase of the epidemic in March, the New York Company suffered more severely than the Bell Telephone Company of Pennsylvania or the Chesapeake and Potomac Telephone Company. In April, however, this was compensated for by the New York Telephone Company having the lowest rate of the three companies. In October, during the second phase of the epidemic, the highest rate of illness was experienced in the Bell Telephone Company of Pennsylvania, the rate being 141 per 1000 against 106 in the New York Telephone Company and 104 in the Chesapeake and Potomac Telephone Company, the rate for all three companies being 115 per 1000.

MORTALITY

Proportion of Deaths to Personnel

Considering both sexes together, the mortality rate of influenza was heavier among the group 25 to 34 years than among any other, whereas the morbidity rate was higher for the group 16 to 19 years; the next highest mortality rate was observed

TABLE 6. — NUMBER OF CASES OF ILLNESS CAUSED BY INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO) DURING 1918, SEGREGATED BY MONTH OF ONSET AND COMPANY

Company	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
New York Telephone Co.	213	156	367	153	38	24	26	28	244	2119	322	355
Bell of Pennsylvania	78	75	107	105	13	16	16	12	262	1240	131	227
Chesapeake and Potomac	61	38	47	36	11	4	4	3	69	464	77	111
Eastern Group	352	269	521	294	62	44	46	43	575	3823	530	693

TABLE 7. — MONTHLY ILLNESS RATES FOR INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO), 1918 [1]

Company	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
New York Telephone Co.	10.6	7.8	18.4	7.6	1.9	1.2	1.3	1.4	12.2	106.0	16.1	17.8
Bell of Pennsylvania	8.9	8.5	12.2	12.0	1.5	1.8	1.8	1.4	29.9	141.4	14.9	25.9
Chesapeake and Potomac	13.7	8.5	10.6	8.1	2.5	0.9	0.9	0.7	15.5	104.3	17.3	24.9
Eastern Group	10.6	8.1	15.7	8.8	1.9	1.3	1.4	1.3	17.3	115.1	15.9	20.9

[1] These rates have been computed on the actual number of cases reported during each month and the average number of employees eligible for benefits during the year — and not upon the number of cases multiplied by the fraction required to raise each month's cases to a yearly basis — for the obvious reason that the number of cases in October, if so multiplied, would exceed the population upon which the rate was based.

in the group 16 to 19 years; then followed the groups 55 to 64 years, 20 to 24 years, 35 to 44 years, and 45 to 54 years, in the order named. If the mortality rate for each sex is now examined separately, the highest rate for males is found in the group 16 to 19 years and the highest female rate in the group 55 to 64 years, but since in both these groups the deaths and exposures were few, it might be better to disregard them, so that when the sexes are considered separately as well as together the highest rates are encountered in the groups 25 to 34 years. The phenomenon of a higher rate among young adults was noted by all observers during the 1918 epidemic and is of interest because in the epidemics of 1890 and 1891 the highest mortality was observed among the very young and the very old.

Mortality of Eastern Group Companies Versus Mortality of New York City

If the mortality rates of New York City from influenza and pneumonia (lobar and broncho) are compared with those of the Eastern Group of Companies, it is found that in the city of New York the mortality for the group 20 to 24 years was 5.73 per 1000 persons at these ages, whereas, among the employees of the Eastern Group at similar ages, the rate was 3.1; and that the rate for the city of New York between the ages 25 and 34 years was 9.07 per 1000, whereas, among the employees of the Eastern Group, the rate was 6 per 1000. Between 35 and 44 years, the rate for the city of New York was 5.01 per 1000, whereas the rate for the companies of the Eastern Group was 2.8. At the other ages, the companies' rates are more favorable, but as the figures upon which they are based were small, further comparisons were not felt to be justified.

The mortality rates of influenza, bronchitis and pneumonia (both forms) for the

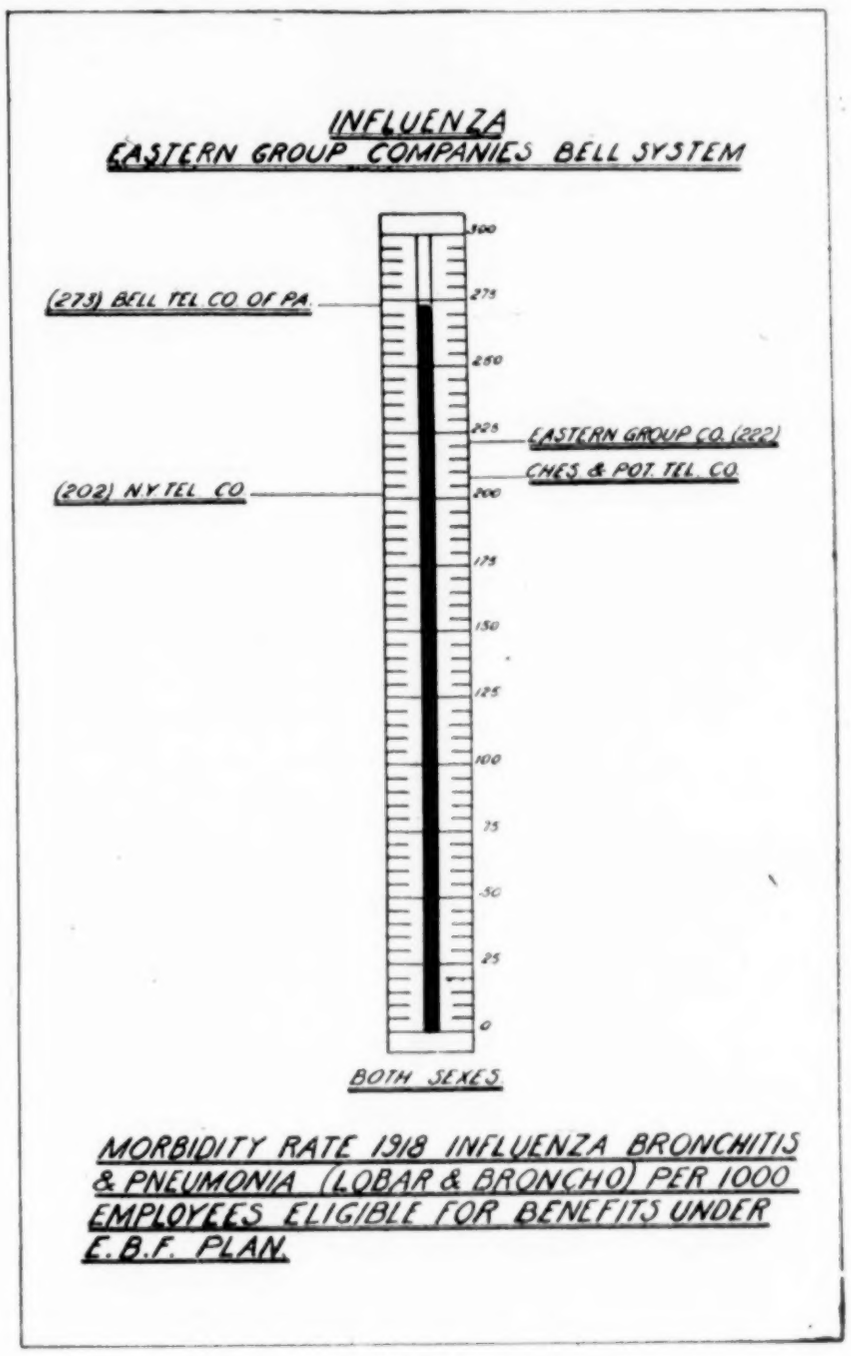

FIGURE 4.

New York Telephone Company compare with those for the city of New York as follows:

Ages	New York City	New York Tel. Co.
20 to 24 years	5.73	3.2
25 to 34 years	9.07	5.5
35 to 44 years	5.01	1.7

These figures indicate that the mortality rate from the above diseases among the employees of the Eastern Group was considerably lower than among the general population, and since there is a definite

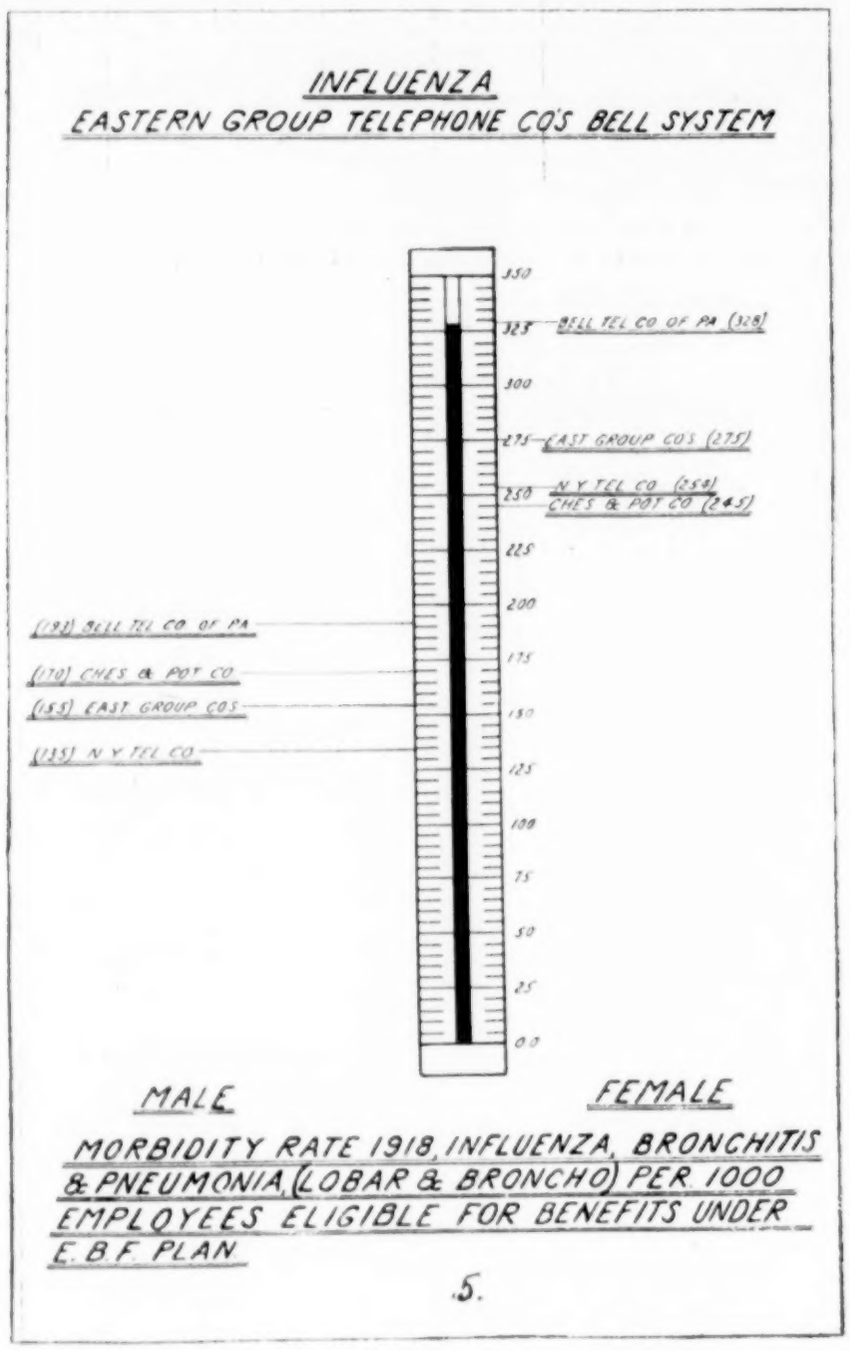

FIGURE 5.

ratio between deaths and illness, it is reasonable to assume that the morbidity from influenza was also less in the Eastern Group. Inasmuch as all observers are agreed that there is a direct relationship between economic conditions and the morbidity and mortality of influenza, the more favorable morbidity and mortality among the employees of the telephone companies may be attributed to their more satisfactory economic conditions.

MORTALITY RATES OF THE DIFFERENT COMPANIES

The mortality rates of the several companies of the Eastern Group show rather marked difference. The lowest rate was experienced among the Chesapeake and Potomac Telephone Company employees — viz., 3.6 per 1000 employees eligible for benefits. The next lowest rate was observed in the New York Telephone Company — to wit, 3.7 The highest rate was recorded against the Bell Telephone Company of Pennsylvania. These differences in mortality rate cannot be attributed to any differences in the environment of the employees of the several companies but to differences in the local manifestations of the epidemic. This opinion is upheld by the public reports which show that Philadelphia suffered a much higher death rate than did New York or Baltimore.

CASE FATALITY BY AGES AND SEX

As has been said elsewhere, the case fatality was higher among the males than among the females for the entire Eastern Group. The case fatality for males was 31.5 per 1000 and for females 12.5 per 1000. This difference in case fatality of the males as compared with the females is observed at every age period save the one from 55 to 64 years, where the male rate was 17.5 and the female rate 200, but this is due to the fact that in the New York Company there were but two cases of influenza among the female employees between 55 and 64 years and one of these died, giving

TABLE 8. — DEATHS CAUSED BY INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO), SEGREGATED BY MONTHS, 1918 [1]

Company	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
New York Telephone Co.	1	0	1	1	2	0	1	0	1	57	5	5
Bell of Pennsylvania	0	0	0	4	0	0	0	0	4	23	6	8
Chesapeake and Potomac	0	0	0	0	0	0	0	0	2	12	1	1
Eastern Group	1	0	1	5	2	0	0	0	7	92	12	14

[1] Deaths too few to justify computing of monthly death rate.

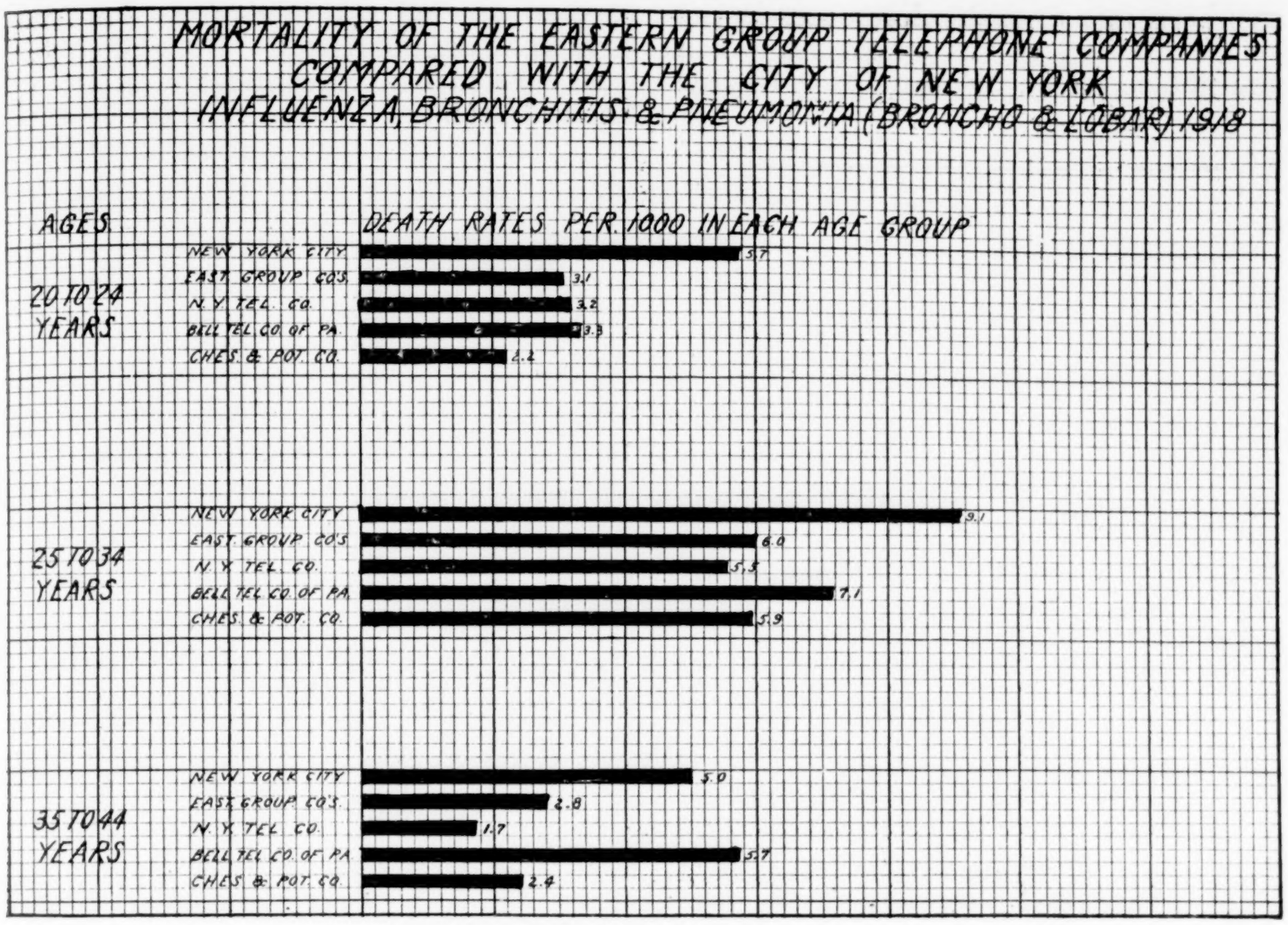
MORTALITY OF THE EASTERN GROUP TELEPHONE COMPANIES
COMPARED WITH THE CITY OF NEW YORK
INFLUENZA, BRONCHITIS & PNEUMONIA (BRONCHO & LOBAR) 1918
AGES
DEATH RATES PER 1000 IN EACH AGE GROUP
20 TO 24 YEARS
NEW YORK CITY 5.7
EAST. GROUP CO'S. 3.1
N.Y. TEL. CO. 3.2
BELL TEL CO. OF PA. 3.3
CHES. & POT. CO. 2.2
25 TO 34 YEARS
NEW YORK CITY 9.1
EAST. GROUP CO'S 6.0
N.Y. TEL. CO. 5.3
BELL TEL CO. OF PA. 7.1
CHES. & POT. CO. 5.9
35 TO 44 YEARS
NEW YORK CITY 5.0
EAST. GROUP CO'S. 2.8
N.Y. TEL. CO. 1.7
BELL TEL CO. OF PA 5.7
CHES. & POT. CO. 2.4

FIG. 6. — Mortality from influenza, bronchitis and pneumonia (broncho and lobar) in the Eastern Group Telephone Companies compared with the city of New York, 1918.

a 50 per cent. fatality rate. Among the female employees of the other companies, between the ages 55 and 64 years, there were no fatalities, which reduced the case fatality of the three companies, considered as a whole, to 20 per cent. But the figures here are so small, that a fatality rate based upon them must be disregarded. The case fatality rates of the different companies displayed rather wide variations, the male fatality rate being 24 for the Chesapeake and Potomac Telephone Company, 30 for the New York Telephone Company and 39 for the Bell Telephone Company of Pennsylvania, while the female fatality rate was 11 for the Bell Telephone Company of Pennsylvania, 13 for the Chesapeake and Potomac Telephone Company and 14 for the New York Telephone Company. These variations in the case fatality rates of the different companies, like the differences in mortality rates, must be attributed to local manifestations of the epidemic, though a small part of them may

TABLE 9. — DEATHS CAUSED BY INFLUENZA, BRONCHITIS AND PNEUMONIA AMONG EMPLOYEES ELIGIBLE FOR BENEFIT UNDER THE EMPLOYEES' BENEFIT FUND PLAN, SEGREGATED BY SEX AND AGE, 1918

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
New York Telephone Co.	1	0	4	17	21	20	5	1	3	0	1	1	0	0	35	39
Bell of Pennsylvania	1	0	2	8	14	10	9	0	1	0	0	0	0	0	27	18
Chesapeake and Potomac	0	1	1	2	6	4	2	0	0	0	0	0	0	0	9	7
Eastern Group	2	1	7	27	41	34	16	1	4	0	1	1	0	0	71	64

have been due to slight differences in the age distribution of the employees which were not corrected by using 5 or 10-year age groupings.

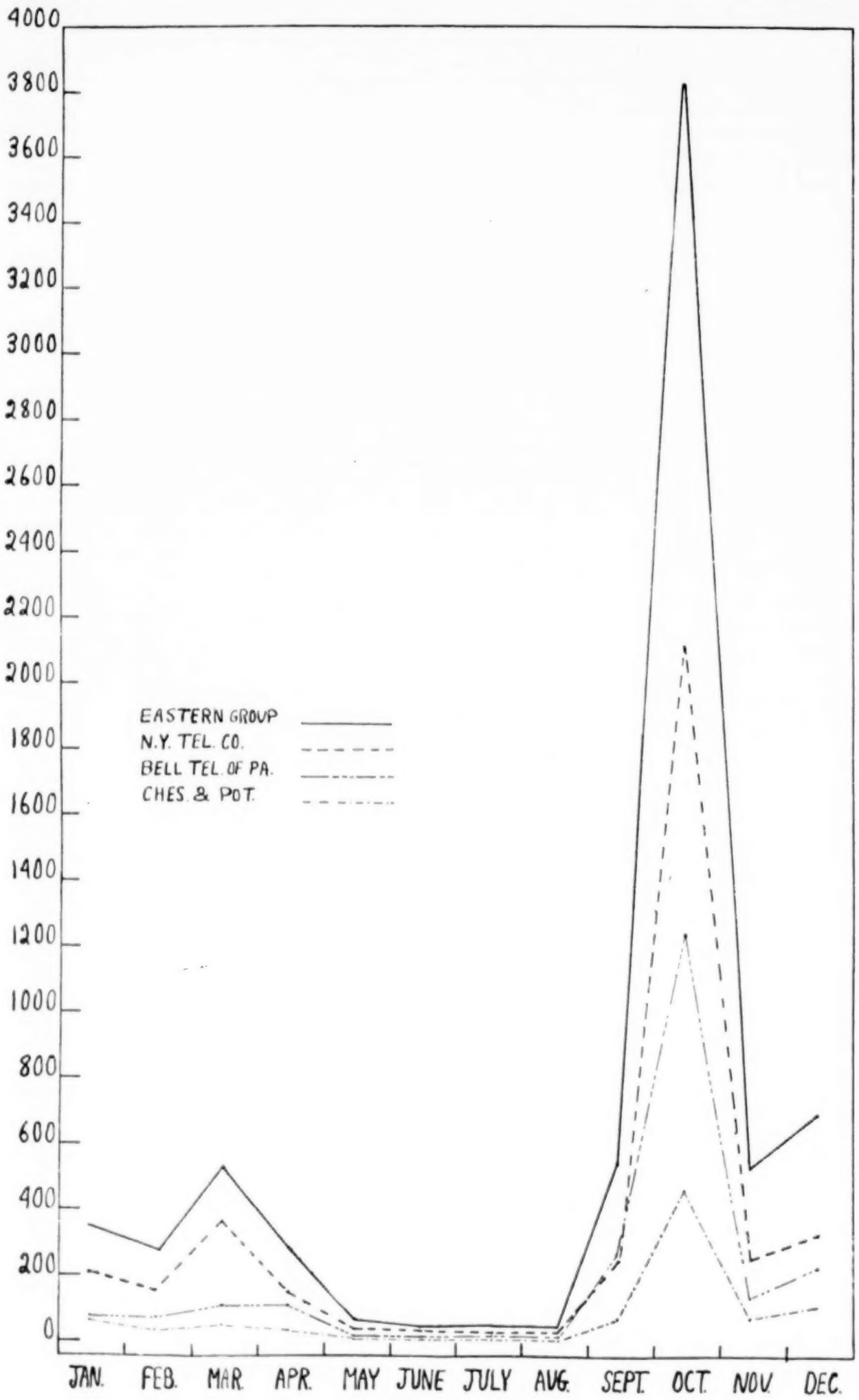

FIG. 7. — Monthly number of cases of illness caused by influenza, bronchitis and pneumonia (lobar and broncho) during 1918.

DURATION OF ILLNESS

The outstanding feature of Table 13, which deals with the duration of illness, is that the duration was shorter among the males than among the females. In other words, a larger percentage of the males recovered or died within eight to fourteen days, than did the females. This difference is manifested in all three companies. In the Eastern Group of Companies 39 per cent. of males recovered or died between eight and fourteen days, whereas 27 per cent. of females recovered or died during the first week of benefits; during the second benefit week the percentage of terminated cases among males and females was practically the same—viz., 23.2 against 23.3. In the third benefit week 15 per cent. of the female cases were terminated as against 12 per cent. of the male cases. During the fourth benefit week 9 per cent. of the female cases were terminated, as against 5 per cent. of the male cases. At the end of thirty-five days, 24 per cent. of the female cases remained unterminated, as against 20 per cent. of the male. The same differences are seen in the duration of the fatal cases among the male employees of the Eastern Group; 60 per cent. of the male cases terminated under eight days, as against 38 per cent. of the female fatal cases. During the second week 33 per cent. of the fatal male cases were terminated by death, as against 46 per cent. for the female. Between fifteen and twenty-one days, 4 per cent. of the male fatal cases terminated in death, as compared with 11 per cent. among the female fatal cases. This would indicate that the disease was more protracted in the females than in the males.

PREVENTIVE INOCULATION

Early in the epidemic many bacteriological laboratories produced vaccines for

TABLE 10.—DEATHS AND DEATH RATES PER 1000 EMPLOYEES ELIGIBLE FOR BENEFIT UNDER EMPLOYEES' BENEFIT FUND PLAN FROM INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO), 1918

Company	Total		16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
New York Telephone Co.	74	3.7	1	1.0	21	3.2	41	5.5	6	1.7	3	2.9	2	6.5	0	0
Bell of Pennsylvania	45	5.3	1	1.1	10	3.3	24	7.1	9	5.7	1	2.1	0	..	0	..
Chesapeake and Potomac	16	3.6	1	6.0	3	2.2	10	5.9	2	2.4	0	..	0	..	0	..
Eastern Group	135	4.1	3	2.2	34	3.1	75	6.0	17	2.8	4	2.2	2	3.4	0	..

TABLE 11.—DEATH RATE FROM INFLUENZA, BRONCHITIS AND PNEUMONIA PER 1000 EMPLOYEES ELIGIBLE FOR BENEFIT UNDER EMPLOYEES' BENEFIT FUND PLAN, SEGREGATED BY SEX, 1918 [1]

Company	Total		16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Eastern Group	4.9	3.4	10.1	0.9	6.0	2.8	6.6	5.5	3.3	0.9	2.6	..	2.1	9.7	..	..

[1] The number of deaths and the number of exposures are too small to justify a computation of rates for age groups for the separate companies. The total death-rate figures for the separate companies are as follows: New York Telephone Co., M = 4, F = 3.5; Bell of Pennsylvania, M = 7.5, F = 3.5; Chesapeake and Potomac, M = 4.1, F = 3.1

TABLE 12.—CASE FATALITY RATE PER 1000 CASES OF INFLUENZA, BRONCHITIS AND PNEUMONIA AMONG EMPLOYEES ELIGIBLE FOR BENEFITS UNDER EMPLOYEES' BENEFIT FUND PLAN, 1918

Company	16 to 19		20 to 24		25 to 34		35 to 44		45 to 54		55 to 64		65 & over		Total All ages over 16	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
New York Telephone Co.	37	0	45.9	11	35.6	23.7	14	13.5	33.3	0	43.5	500	0	0	29.6	13.6
Bell of Pennsylvania	166.7	0	30.8	7.8	36.9	19.2	50.5	0	22.2	0	0	0	0	0	38.9	10.6
Chesapeake and Potomac	0	19.6	34.5	7.1	35.5	22	17.5	0	0	0	0	0	0	0	23.9	12.7
Eastern Group	51.3	1.9	38.7	9.5	36.0	22	24.7	6.1	23	0	17.5	200	0	0	31.5	12.5

TABLE 13.—DURATION OF ILLNESS CAUSED BY INFLUENZA, BRONCHITIS AND PNEUMONIA (LOBAR AND BRONCHO) BY SEX, 1918

Company		Total Cases of Influenza, Bronchitis and Pneumonia among Eligible Employees		Duration of Illness									
				8 to 14 days 1st Benefit Week		15 to 21 days 2d Benefit Week		22 to 28 days 3d Benefit Week		29 to 35 days 4th Benefit Week		Over 35 Days	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
New York Telephone Co.	Male	1170	100	420	35.9	217	18.5	138	11.8	56	4.8	339	29.0
	Fem.	2847	100	676	23.7	604	21.2	407	14.3	281	9.9	879	30.9
Bell of Pennsylvania	Male	678	100	301	44.4	194	28.6	79	11.7	46	6.8	58	8.5
	Fem.	1685	100	564	33.5	432	25.6	271	16.1	144	8.5	274	16.2
Chesapeake and Potomac	Male	375	100	150	40.0	107	28.5	52	13.9	21	5.6	45	12.0
	Fem.	545	100	163	29.9	149	27.3	99	18.2	53	9.7	81	14.9
Eastern Group	Male	2223	100	817	39.2	515	23.2	269	12.1	133	5.5	442	19.9
	Fem.	5077	100	1403	27.6	1185	23.3	777	15.3	478	9.4	1234	24.3

the prevention of influenza. The Department of Health of the city of New York prepared and distributed a vaccine prepared from the bacillus of Pfeiffer. Most of those produced by other laboratories were mixed vaccines containing the bacillus of Pfeiffer, streptococci, staphylococci, and pneumococci. The medical departments of the telephone companies obtained a supply of the Health Department vaccine as soon as it was ready for distribution and offered free inoculation to employees, many of whom availed themselves of the opportunity. Had it been possible to have secured adequate controls, the statistics of the results of these inoculations would have been very valuable. Unfortunately the changing personnel of large corporations does not furnish conditions under which adequately controlled studies of the effectiveness of preventive inoculations can be made. For this reason it has not been possible to make a detailed analysis of the reports of these inoculations. Suffice it to say, that in not one instance among the great many employees vaccinated were any disagreeable symptoms or marked reactions encountered. In several offices where a representative number of employees availed themselves of inoculation, there seemed to have been a decidedly lower incidence of influenza among the inoculated than among the non-inoculated: in fact, the difference was so marked and the environment of the employees so similar that it would seem to indicate that the vaccination had exerted some influence in preventing infection among those inoculated. On the other hand, since the laboratory workers are far from agreement as to whether the bacillus of Pfeiffer is the exciting organism of influenza, there would seem to be little scientific reason for preventive inoculations with vaccines of this organism.

Notwithstanding the adverse testimony of the bacteriologist, some experts in public health work are of the opinion that preventive inoculations are of value. In view, then, of the undetermined value of vaccines as preventives of influenza, the medical departments should not institute vaccination against influenza as a routine procedure but its harmlessness and possible value should be explained to interested employees and the operation performed for any of those who desire to avail themselves of its possible benefit.

Other Activities

During the epidemic of 1918, many precautions were taken in the companies of the Eastern Group to limit the spread of the disease, and all possible assistance and care was given employees. They were kept under close observation, and sent home and put under the care of their physicians at the first signs of a cold or cough. Generous leaves of absence with benefits were granted for convalescence. Arrangements were made for hospital care in a number of cases. In Washington, D.C., where there was a group of operators brought from other cities to help in carrying the enormous service load in that city during war time, an efficient hospital was organized on the shortest notice and a capable physician, assisted by a staff of nurses, gave all his time to the care of the employees. A rest home for convalescent cases was established in the outskirts of the city, with the best of results. Every local district officer of every division of each company did his or her share towards fighting the epidemic. And the extremely small number of deaths from influenza in the Eastern Group may fairly be ascribed to the loyal, patient teamwork of all concerned — from the humblest individual employee to the executive officers of the group.

General Conclusions

The prevention of influenza is not to be secured by any general or wholesale hygienic procedures, as in the case of typhoid fever by the purification of water supply and the pasteurization of milk supply, because the virus of influenza is transmitted by direct contact with infected persons, the germs of the disease being contained in the discharges from the respiratory passages of such persons.

Flexner has pointed out that the ideal method of combating this disease is its eradication from the localities where it is endemic and from which epidemics, or rather pandemics, spread. Such a method of attack, while logical, is not at the present time practical because of the expense involved and the low standard of national intelligence and lack of appreciation of public health on the part of the countries where the disease is dormant. It would, therefore, seem that this is a problem that must be solved by the concerted action of

the allied countries that suffer from visitations of this epidemic disease.

Since suppression at the source, as above described, is at present impractical, the next step that suggests itself is governmental quarantine; but here, because of the ready communicability of the disease and the present-day rapid methods of travel, control of epidemics of influenza by quarantine is very difficult if, indeed, not impossible. In New York City, Philadelphia and other large cities, the overcrowded condition of the transit lines adds to the difficulty of preventing the spread of the disease by infected persons. Therefore, in the final analysis, prevention is in the hands of the individual, and each must carry out his or her own preventive measures. Consequently, the function and the duty of the medical departments of the companies should be:

1. First to instruct employees as to the nature of this disease, the manner in which it is transmitted and the methods of prevention. Since the disease is spread only by infected persons coughing, sneezing, and expectorating, etc., without observing the proper precautions, and by the use of common drinking cups as well as the use of glasses, cups, dishes, and eating utensils that have not been thoroughly cleansed with boiling water, this end can be best accomplished through instruction and propaganda.

2. Should the epidemic of influenza recur to an extent which would warrant it, noonday talks should be given by the physicians and nurses of the medical department, and bulletins and news items issued in the official journals of the several companies.

3. These steps should be followed up by persistent efforts to detect cases of the disease in their incipiency among employees, in order that they may be at once sent home, primarily to protect their fellow employees from infection, and also that the sufferers may receive prompt and adequate medical care. The statistics of the Eastern Group, as well as those of other observers, conclusively show the importance of prompt and effective treatment. Supervisors, office managers, etc., should be instructed to be on the lookout for employees suffering from colds in the head, sore throats and similar conditions, and impressed with the necessity of referring such cases immediately to the medical department for examination.

4. Should the epidemic become severe, the nurses and physicians of the medical department should visit the various offices of the company each day for the purpose of making a rapid inspection of the employees in order to detect early cases.

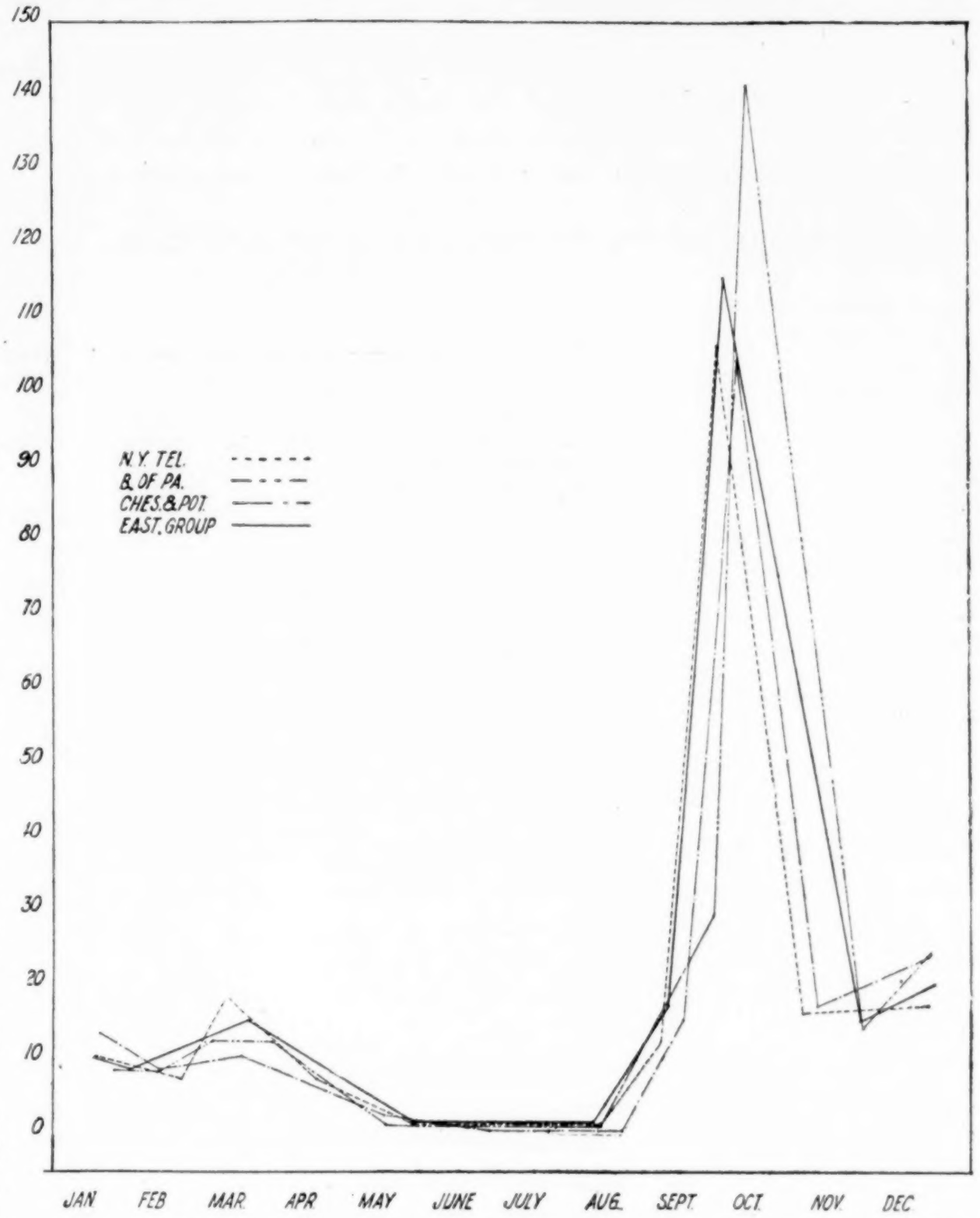

FIG. 8. — Monthly illness rates for influenza, bronchitis and pneumonia (lobar and broncho) during 1918.

5. Masking is of very doubtful value unless the mask is worn continually and is so constructed that it will thoroughly filter all the air breathed. Such a mask would be absolutely impractical for operators to use while on duty. Its practical value is questionable and its general adoption would tend to cause unnecessary hysteria. This was the attitude taken during October, 1918.

6. Gargling and spraying the nose and throat with various bactericides, such as argyrol and protargol, have some value. But in order to be effective, it must be done at very frequent intervals. Further, the procedure is apt to give a sense of false security which causes persons to be less mindful of the more practical methods of prevention.

7. All employees who have been ill with influenza should, before returning to duty, visit the medical department in order to make sure they have completely recovered. The general experience during the epidemic of 1918 was that persons who returned to work too early came down with relapses which, if they did not result fatally, at least caused protracted illness with annoying sequelae. Such examination is also necessary to make sure that employees are no longer harboring the germs of the disease which they might transmit to their fellow employees.

8. Inasmuch as diseases of the cardiovascular, respiratory and nervous systems are frequent sequelae of influenza, all persons who were ill with this disease during the past epidemic should be informed of the advisability of being examined either by the medical department or by their private physicians, in order that any of these diseases, should they appear, may be promptly detected and treated.

9. Discussion of what is undoubtedly the most important preventive measure has been reserved for the last — that is, good health. Good health is the most effective preventive of all diseases. If we will but keep our bodies in a healthy condition by proper hygiene, right living, careful eating, sufficient sleep, ample exercise, and all the fresh air and pure water we can consume, nature will keep a standing army and navy of "antibodies" that will conquer any and all invaders.

TABLE 14. — DURATION OF FATAL CASES OF INFLUENZA, BRONCHITIS AND PNEUMONIA, BY SEX, 1918

Company	Sex	Total Deaths from Influenza		Duration of Illness									
				Under 8 Days		8 to 14 Days		15 to 21 Days		21 to 28 Days		Over 28 Days	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
New York Telephone Co.	Male	34	100	23	67.6	8	23.5	1	2.9	..	..	2	5.9
	Fem.	39	100	19	48.6	14	35.8	5	12.8	..	..	1	2.9
Bell of Pennsylvania	Male	27	100	11	40.7	15	55.5	1	3.7	..	..	..	..
	Fem.	18	100	3	16.6	12	66.6	1	5.5	1	5.5	1	5.5
Chesapeake and Potomac	Male	9	100	8	88.8	..	..	1	11.1	..	..	..	..
	Fem.	6	100	2	33.3	3	50.0	1	16.7	..	..	..	..
Eastern Group	Male	70	100	42	60.0	23	32.8	3	4.3	0	..	2	2.8
	Fem.	63	100	24	38.1	29	46.0	7	11.1	1	1.6	2	3.2

Summary

1. Influenza is a highly contagious epidemic disease.

2. Public health methods of prevention have little effect upon epidemics when once started.

3. Prevention at the present time rests almost entirely with the individual, and the best method of preventing infection is by the maintenance of good health and good hygiene at business and at home.

4. Preventive vaccination is of doubtful value.

5. The early detection of cases is of the greatest importance in order to prevent transmission of the disease to others and in order to secure immediate treatment for the patient, thereby insuring early and complete recovery.

6. Men suffer a greater fatality from influenza than women, probably because of their disposition to make light of the primary symptoms of the disease and to con-

tinue at work until they are overwhelmed by it, by which time their chances of recovery are poor. Hence, special attention should be given the disease among male employees.

7. All persons who have been ill with influenza should be examined before being permitted to resume work in order to make sure that they are no longer infectious, lest they transmit the disease to their fellow workers, and to make sure they have completely recovered so that they will not suffer relapses resulting in protracted illnesses.

8. Such persons should also be examined at intervals after they have been permitted to return to work, in order that the chronic diseases which frequently follow influenza may be promptly detected and properly treated.

NOTES UPON AN UNREPORTED CAUSE OF OCCUPATIONAL DERMATOSIS *

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WHEN one meets with a case of occupational dermatosis, it is difficult to be certain whether or not a similar example has been previously mentioned. It so frequently happens that observers record new forms, as they crop up, in out-of-the-way periodicals and pamphlets. The whole subject does not lend itself to an orderly or connected classification, and for that reason has never been systematically summarized. Single instances appear in literature under various headings, particular trades, industries, occupations, chemical and physical agents, etc. Books on dermatology, and even those which deal exclusively with occupational diseases, discuss the matter meagrely and incompletely. To make references more easy, descriptions less disjointed, and safeguards better known, the methodical writer should endeavour to outline each injurious stage in the process of manufacture and uses of a material, or agent, and at each point indicate the noxious agent at work.

Animal skins, with their appendages, undergo many and complicated processes to be made serviceable for ordinary trade purposes. We are familiar with a number of the skin troubles they bring. Glibert (1) reported a curious, slow, progressive erosion of the skin of the fingers of men who scrape the skins and hair of rabbits. We know well the classical pemphygoid eruptions, acute and fatal or chronic and uncertain, in the handlers and strippers of dead carcasses. The septic sores leading to widely spreading lymphatic toxaemia, and the bacillogenic diseases, such as anthrax, from infected blood and dried secretions have been fully described. Out of 542 persons engaged in dressing, dyeing, and manufacturing furs, Kober (2) finds, after a careful inquiry, that no less than 163 suffer from skin diseases. Some are due to the arsenious oxide used in the preservation of the pelts; others, to the dyestuffs such as "ursol" (paraphenylene diamine), most commonly used to produce a brown colouration in furs. This substance can bring out a rash on either the dyer or wearer. We have further the callous formations on the hands of the dressers, cutters and beaters of furs, the prominent "segs" on the thumbs of the whitener of leather, and the "splayed" hand of the dresser, constituting veritable trade-marks in these workers. Other well-known disabilities in these industries are the fissures on the hands of "plankers" from the action of mercurous nitrate. In the hat-making trade this salt is required to make cut-fur, felt or interlace. Lastly, we must mention the holes seen in tanners caused by chromic acid. These are well known in many countries, each of which gives them a slightly different pet name. In England the labourer calls them simply "birds' eyes"; the French worker says they resemble the eyes of a "young pigeon"; and the German labels them the "gold-finch" ulcer. Chrome ulcers may end in serious mutilations.

The particular object of these notes is to draw attention to a skin complaint which attacks certain employees engaged in the fellmongers' yard. This work precedes that of tanning. In the first stage of the leather trade fresh skins called pelts are cured, and the epidermis with its appendages removed. In the case of sheep and the smaller animals this is done in fellmongers' yards. The skins of cattle, horses, deer, pigs, etc., required to make other varieties of leather, are cured and unhaired at different establishments or in the annexes to tanyards. The treatment is very much the same in both.

In the fellmongers' yard, if the hair or wool is intended to remain on the pelt, this is steeped in brine. If the wool requires removing, the fleshy sides of fresh or salt-free sheepskins are laid against each other, having previously been liberally brushed over with a thick cream containing an excess of slaked lime and 5 per cent. sodium sulphide. They are then lifted into the floods or vats by men called jobbers or washers. After remaining there for a suf-

* Received for publication Oct. 31, 1919.

ficient time, the pelts are carried to the washing pits by the curers.

Gloves are invariably worn for the first removal, particularly in the foreign pelt trade, where a very strong solution of sodium or calcium hydrosulphide is used as a quick unhairer.

In the second removal and also during inspection the hands are bare, and the beginner or careless worker suffers great discomfort owing to redness, tenderness and cracks which appear on the hands (3) from

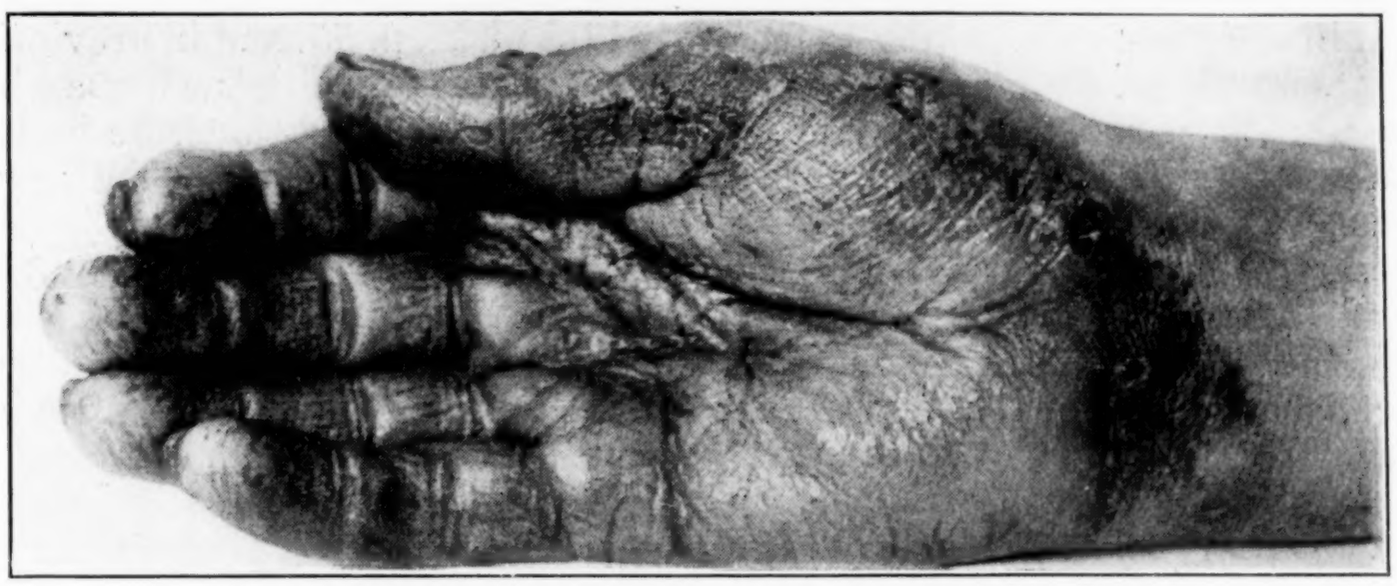

FIG. 1. — " Pullers' " rash from unhairing sheep's pelts. Note distribution and characteristic lime holes.

these chemicals. In these workmen as many as four to a dozen small ulcers, the size of a split pea, will be seen on the sides of the knuckles and on the interdigital skin of the fingers. The knuckles are swollen and inflamed.

The pelts are then conveyed to the unhairing room and placed, hair uppermost, on the pulling beam. The pullers scrape off the hair or wool by rubbing down the woolly skin with the balls of the naked thumbs and the ulnar edges of the palms of both hands. The characteristic rash and holes appear on these parts in the pullers. An expert puller will unwool 1000 sheep in a week.

The interaction of sodium sulphide with milk of lime produces calcium hydrosulphide and caustic soda. These cause the mischief in this particular trade. If neglected the ulcers penetrate deeply, the sores easily becoming infected, causing inability to work.

An effective trade-shop remedy is a drop of Stockholm tar applied to each hole. This appears to act as a protective, enabling the men to " carry on." Frequent washings of the hands in a weak solution of vinegar and water followed by the thorough rubbing in of an ointment are helpful preventatives. The ointment the writer prefers is as follows:

℞

Zinci oxidi	ʒ i
Acidi oleici	ʒ ix
Emplastri plumbi	ʒ x
Parenol	ʒ xxxviii
Hydrargyri ammoniati	ʒ vi

Misce.
Fiat unguentum.

This is a useful line of treatment in many trade processes where eruptions are liable to occur from the use of strong alkalies.

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PNEUMOKONIOSIS IN MAN AND HORSE*

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IN the ordinary conditions of living, the desirability of effective nose-breathing is rightly insisted upon by hygienists. In the unclean state of the atmosphere associated with many industries, the importance becomes much enhanced. It is well known that the vibrissae at the entrance of the nostrils impede and collect minute particles, micro-organisms, etc., floating in the inspired air. The part is well bathed by the exudations from the large and branching mucous glands, which further entangle any fine dust. Noxious germs are thus caught, and their activity lessened or destroyed by the cells of a healthy mucous membrane. Mucus is not a favourable culture medium and, in health, the surface of this membrane is usually sterile beyond the vibrissae. In normal weathers a strained, warmed and moistened air thus reaches the lungs.

In the habitual mouth-breather this important and constant safeguard is absent. The tonsils appear unable to perform their function, and if they or the pharynx are diseased (which they usually are in mouth-breathers), pyogenic bacteria are freely present. Air passes with greater force through the mouth, itself a hotbed for pus formation, so any air-borne cells and dust will more readily be carried into the bronchi. The nose and pharynx are not sterile when inflamed, and their normal deposit chambers are put out of action when obstruction is present.

This sieving property is well illustrated by the lesions inflicted at this part of the nose in workers in certain chemical powders. Dry chrome salt, some arsenical green colours, sheep-dip preparations, basic slag, the pollen of moulds and the fibres of certain vegetables are well-known causes of rhinitis, followed by ulceration of the nose at this particular point of the septum.

Dr. W. C. Rivers has elaborated the view that mouth-breathers are more liable to pneumokoniosis and possibly to tuberculosis than nose-breathers in an article on *Pneumokoniosis in Man and Horse* (Lancet, 1919, Vol. II, p. 55, and in previous papers). Comparing man with the horse when placed under similar conditions, he finds that the horse — a nose-breather entirely — never suffers from " miner's lung." He reports Haldane as saying that " the lungs of horses are less black than those of men." The article is both suggestive and interesting.

The habitual mouth-breather is thus deprived of one of the natural defences against the inhalation of objectionable industrial dusts. This loss is either congenital or acquired. Amongst the former are syphilitic or strumous deformity or defect of the nasal bones. Amongst the latter are adenoids, polypi, repeated colds and catarrhal states of the mucous membrane. The question is thus raised as to whether such sufferers should be excluded from working in dusty occupations? So far as the adult is concerned, there may be a doubt in any individual case, and the nature of the material worked with may be taken into consideration. On the other hand, it seems certainly imperative that children and young people affected by any of these disabilities should be excluded from such places as the mixing, card and spinning-rooms of cotton mills, or other dust-raising processes.

Rivers thinks that atrophic rhinitis should debar from work in such atmospheres, because this disease abolishes the filtering and other protective features of nasal breathing and allows the air to reach the lungs too readily.

* Received for publication Oct. 31, 1919.

THE CONTROL OF INFECTIOUS DISEASES IN INDUSTRIAL COMMUNITIES *

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THE protection of a community against communicable disease is not a purely medical problem. Successful accomplishment is, indeed, based upon the facts of etiology and transmission. But the task of the sanitarian demands not only the judgment derived from experienced knowledge of scientific facts, but requires equally a close study of economic and social conditions and a sensible appreciation of the importance of educational propaganda and administrative organization.

The fundamental principles underlying the prevention of infectious diseases are, of course, the same whether we are dealing with industrial centers, military camps, schools or municipalities. There are, however, a great many details of practical management which must be adapted to the peculiarities of each particular community. Thus, the size of the group, the nature of its occupation, the average age of its members, and the environment in which its daily tasks are performed will materially affect the methods of approach and the thoroughness with which its problems can be met. The measures suitable for the protection of an isolated military unit of moderate size, upon the appearance of meningitis, should, in our opinion, differ fundamentally from those carried out in the face of a similar outbreak among divisional troops scattered over a combat area or on the march. This, again, would call for procedures distinctly different from those undertaken when the same disease appears among school children in a crowded city district, or again, among factory workers in a small industrial town. While it is possible, therefore, in laying down fundamental principles, to generalize concerning the sanitary management of any given disease, it is, at the same time, of great importance to develop the details with specific reference to the particular surroundings in which the disease appears. The necessity for such individual treatment of the problems of infectious disease has long been recognized in connection with school hygiene, and is rapidly forcing itself upon the attention of those interested in the development of industrial health control.

It is not, of course, possible entirely to separate school or factory control from the problems of general state health supervision. In the last analysis, protection against infectious disease is a state responsibility and the enforcement of preventive measures must be initiated by state and municipal health boards. But the task of the state will be rendered exceedingly difficult, perhaps even impossible, unless its resources are re-enforced by internal protective organizations provided within the various sub-communities such as those represented by schools and industrial units.

Whenever a group of individuals is brought together in daily association there is created a possible center for the transmission of infection. The members of these groups, exposed to the dangers of such occupational association, may carry disease to the homes to which they scatter when the day's tasks are done, and, conversely, they can pick up infection in their homes, in public conveyances and in places of amusement and carry it to the factory or office. The place of daily congregation, therefore, becomes a sort of clearing house for the distribution of infection. In consequence, there must be co-operation between the municipal or state authorities and those in charge of the industrial unit. The obligation of the internal organization is, of course, primarily to the workers themselves, protecting them against the dangers of infection during the performance of their duties. This is its first purpose not only for humane considerations, but in the interests of economic efficiency as well. Secondarily, such internal sanitary supervision will react favorably upon the health of the community as a whole, by individually controlling these potential foci of transmission.

To a considerable extent co-operation of this nature has already become an integral part of the organizations for health control

* Received for publication, Nov. 28, 1919.

in many industrial regions. Factory legislation, inspection by the state and regulations formulated by some labor unions have accomplished much in encouraging and, in some instances, in enforcing the establishment of sanitary conditions. The purely prophylactic phases of the problem are, in this way, being taken care of by the rapid development of interest in industrial hygiene. And the prophylactic problem is, of course, by far the more important phase of the subject, for, as Soper has correctly stated in a recent article, the epidemic diseases are being conquered not so much because of the direct measures taken against them individually, as because of the many indirect influences that are brought into the lists and which may be summarized as a "higher standard of living." Attention to proper ventilation, the avoidance of fatigue, washing facilities, sufficient and clean lavatories, maintenance of suitable temperature whenever possible, rest hours and the provision of cleanly restaurants and dining rooms, opportunities for exercise and recreation, drinking-water control, dust prevention and specific measures of protection against poison gases or bacterial infection in trades necessitating contact with such factors of injury—these constitute the important general sanitary measures which diminish the probabilities of infectious disease as far as the local conditions are concerned. The thorough development of such measures to the limits of possible enforcement will be the immediate care of those in charge of industrial health control. The importance of such general sanitary measures is, I believe, sufficiently recognized by health authorities and by employers. The principles underlying them are simple, easily explained to every sensible layman, and their practical application can be presented as a definite proposal to invest a certain amount of capital in an undertaking which is sure to yield a high percentage return, not only in terms of philanthropy, but in increased economic efficiency, actually calculable in terms of dollars and cents.

It is not with such matters of general sanitation that we will concern ourselves in the present paper. They constitute a separate chapter in the story of preventive measures, and are more or less thoroughly discussed in such works as Rosenau's *Preventive Medicine* (1), Price's *Modern Factory* (2), etc. Moreover, the experience of many men who have had practical contact with these problems is being gradually written into our state laws in the form of industrial sanitary regulations. Our purpose in this paper is rather to deal with the management of outbreaks of disease which may occur in spite of the protective walls of sanitary supervision, and to indicate the specific method of approach that we believe most suited to the suppression of each disease under conditions such as those likely to prevail in factories and industrial centers. These matters cannot be codified. They will vary with the discovery of new facts about the transmission of disease and they will be subject to change of details according to variations in the size, the organization, and the industrial purposes of the individual plants.

As indicated above, the arrest of an epidemic once well started is infinitely more difficult than the suppression of a focus at a time when a few cases only have occurred. It may almost be said that a system of prompt information of early cases is by far the most important factor for success. The most elaborate organization for hospital care, epidemiological investigation, sanitary construction, etc., is rendered useless unless there is a proper starting device for this machine in the form of an efficient system of information. Fortunately, it is not difficult to organize a system which can elastically be adapted to plants or communities of any size.

Let us assume that we are dealing with a plant where workers, when first being employed and periodically thereafter, are subjected to a physical examination — a thing which we assume is being carried out in most industrial communities in which this type of work is being done at all. It will be a simple matter to add to the record of each worker his infectious disease history. It is, of course, impossible to obtain accurate data of previous infectious diseases for more than a limited percentage of individuals, but reasonable accuracy can be attained for a relatively large percentage and, since a considerable number of these will have been treated in hospitals accessible by mail, all recent attacks of infectious disease can be definitely ascertained. The value of such records cannot be overestimated when measles or scarlet fever or other diseases in which one attack conveys a relative immunity occur in a plant. There should be added to such records, the date and success

of the last smallpox and typhoid vaccination, and whether or not the individual has had horse serum injected in the form of antitoxin, since this fact is becoming an increasingly important matter in connection with subsequent serum treatments. The record should show also the number in the family, age of children, whether they are attending school and where.

When the worker is once established as an employee, his or her place of residence can be marked on a spot map, and maps kept of the places in which the various workers live with their families. In cases in which the plant is sufficiently large to warrant the necessary personnel, periodical visits to the residences of workers and advice concerning ventilation, sleeping quarters, etc., will probably be increasingly well received as the purposes of this service become apparent. This will also serve in checking city inspections and the enforcement upon landlords of sanitary regulations. With this knowledge constantly available and kept up to date by periodical correction, a liaison can be established with the local municipal health officer. The health officer of the given industrial plant should receive the daily reports of communicable diseases which come to the health department of the town or locality. With colored pins or other simple means of marking, it is a relatively easy matter to keep a record of the mutual relationships of diseases that may occur at the plant and those which occur in the community at large.

It goes without saying that the health officer should be thoroughly familiar with such general public health arrangements as the municipal and local water and milk supplies and, if a laboratory is available, he should periodically have his own examinations made.

In the problems of individual medicine, the measures of relief and therapeutics are matters that primarily concern the attending physician and surgeon and his immediate staff. In this relation there is a certain therapeutic advantage in keeping the patient in ignorance of the plan and purposes of the measures adopted for his welfare. In contrast to this, in community medicine success or failure depends to the very greatest extent upon the co-operation of the entire group. Fortunately, the principles on which public health measures are based are, for the most part, exceedingly simple.

In carrying out an educational campaign for laymen it is neither necessary nor desirable to go into scientific details about the characteristics of individual communicable diseases except as a specific aid in meeting an existing emergency. It is best to speak in general terms and to classify the diseases, against which the community is to be protected, into groups as follows:

I. The *respiratory diseases*, conveyed by the mucus of the upper respiratory passages and acquired by entrance through these same passages.

II. The *intestinal diseases* transmitted by intestinal discharges and taken in by ingestion.

III. *Disease transmitted by* the intermediation of *insects*.

For each one of these groups a general scheme of safeguards may be outlined which will, to a considerable extent, convey the necessary information for all diseases included in each respective group.

By means of informal lectures or through circularized bulletins, analogous to those issued from the headquarters of armies as "Official Bulletins" or "Special Orders," such information can be passed on to the members of the community.

We will not attempt to formulate such communications in detail but will discuss each group of diseases in a general way, as a basis for general educational work, and will then take up individual conditions with more particular attention to technical matters.

I. RESPIRATORY DISEASES

General Considerations

When speaking of respiratory diseases from a sanitary point of view, we mean not only the diseases that manifest themselves in respiratory symptoms and pathological changes in the respiratory organs, but we include all other conditions in which the infectious agent or virus is distributed with the saliva and mucus and enters the new host through nose or mouth. We must include, therefore, in addition to the pneumonias, influenza, and various forms of bronchitis, such diseases as measles, scarlet fever, smallpox, and chickenpox, diphtheria, meningitis, and mumps. Were we dealing only with the protection of healthy individuals against patients suffering from such diseases, the problem would be comparatively simple, since early diagnosis, isolation of the sick, and care in delaying the discharge from hospital until the patients have ceased to be infectious would suffice to provide an adequate insulation about our

focus. Unfortunately, however, this is not the case. Many individuals are immune or highly resistant to micro-organisms which can cause disease in others, and we are, therefore, confronted with the so-called "carrier" problem which considerably complicates the difficulties of sanitation. This we will take up more particularly below.

It is perfectly natural that progress in preventing respiratory diseases has lagged considerably behind that attained in connection with those acquired by ingestion. It is far easier to control the things which people swallow as food than it is to supervise the innumerable possibilities of casual contact with the saliva of others, the spray sneezed or coughed into the atmosphere of closed spaces, or to control the universal habits of spitting and uncleanliness with nasal secretions.

There is, perhaps, no single factor which is more conducive to the spread of communicable respiratory disease than that of *crowding*. It is not feasible to give specific measurements of air space per individual for all cases since this must necessarily vary according to the nature of the work. Speaking generally, however, we should say that with proper ventilation there should never be less than 500 cubic feet for every individual employed, and that provisions for the removal of dust, incident to the work, must be provided.

The matters of *ventilation* and *sunlight* are of great importance, as is also the question of suitable temperature adapted to the degree of physical labor employed in the work.

Advice as to *clothing* is essential since it has been our experience that the laboring population, subjected often to insufficient heating in homes, is apt to dress too thickly in heavy woolen underwear, and consequently be subjected to sudden changes of temperature in going in and out while freely perspiring. It is desirable to arrange dressing rooms when workers are employed in heavy physical labor where, during the cold months, dry clothing can be put on before leaving work.

Whenever the workers eat at a common mess or restaurant the utmost attention should be paid to the proper *washing of dishes* (3) since in army experience there have been unmistakable indications that lack of proper cleansing has led to the transmission of respiratory infections. Actual boiling of dishes, while not always feasible in the army, should offer no difficulties under ordinary industrial conditions.

Spitting should be suppressed and spittoons, when provided, should be properly cared for so that they may not merely serve as filthy targets for many bad shots. In the American Army, particularly, spitting was a habit difficult to overcome and the fact that after all it is merely an unsanitary habit was shown by the fact that spitting was hardly a problem among the British and French.

Another matter of importance in the prevention of respiratory diseases is that of *wet instead of dry sweeping*. In most places that are properly supervised the vacuum cleaner has solved this difficulty, but where this is not in use the abundant sprinkling of floors while sweeping is an extremely important matter. Dry sweeping serves merely to redistribute bacteria and hurl them into the air; and there is increasing evidence to show that slow drying, as in dust, does not kill bacteria as rapidly as we had formerly believed. Stillman (4) has shown that virulent pneumococci can survive in dust, and a similar suggestion has been made in the case of poliomyelitis by Neustaedter and Thro (5). In the spread of dysentery, some British observers have assumed that distribution of living bacilli in dust has been of considerable importance, and our own epidemiological observations on two influenza epidemics in France have inclined us to believe that here, too, dust may have played a rôle in the transmission of the disease.

The mere supervision of these matters in the factory itself will not suffice, since the most dangerous exposure to respiratory infection may not necessarily occur during the working hours, but is much more apt to take place in sleeping quarters at night. In this respect the home of the worker can be reached only by advice and education as stated above, and it would seem to us a relatively simple matter, in industrial communities composed of intelligent workers, to establish a relationship of such mutual confidences with the working body that advice will be followed and that advisory visits to the homes will be permitted or even invited by the members of the group. It must be borne in mind that as far as respiratory infection is concerned the most concentrated and prolonged exposure occurs in sleeping quarters. If this factor were rigidly controlled, a very material diminution of this type of infection would occur. The astonishing influence of such control has been repeatedly observed in military sanitary work.

The Common Cold

In the general sanitation of respiratory diseases, it is our opinion that too little attention has been given to the so-called "common cold." This malady, though it probably causes a cumulative loss of efficiency in civilized populations greater than that caused by any of the other respiratory diseases, except perhaps tuberculosis, is the least well understood of these maladies. We do not know whether it is a single clinical entity or whether it represents mild attacks of a variety of catarrhal inflammations of the nose and pharynx. We do not know whether it is caused by a single or by a variety of infectious agents. Though streptococci, pneumococci, and various bacilli have been looked upon as the causative agents from time to time, none of these bacterial invaders have been definitely determined as specific factors. Recently Kruse (6), Foster (7), and others have suggested the possibility of a filtrable virus as

the infecting factor, a suggestion which is based on a number of positive experiments on human beings with filtered mucus. The supposition is indirectly borne out by the uniformly inconclusive results of purely bacteriological researches, by the absence of bacteria from the mucus of the early cases and by the extraordinary infectiousness of the condition. Our own observations of a few unpublished experiments by Hopkins in our laboratory would incline us to favor the possibility of a filtrable virus.

We cannot undertake in this place, however, to deal with the etiological problem in anything but a very cursory manner. Whatever the etiology may be, it is of the utmost importance that practical prophylaxis shall recognize the importance of serious attention to the common cold. This is necessary not only because the catarrhal inflammation of the nose, throat, and pharynx incident to this condition prepares a site for the lodgment and development of influenza bacilli, pneumococci, streptococci, diphtheria bacilli, and other organisms that may give rise to more serious disease, but also because the sneezing, coughing, and spitting of persons with colds result in the promiscuous distribution of micro-organisms lodged by chance in the upper respiratory passages of the subject. A carrier of virulent bacteria of the varieties mentioned may be relatively safe as an associate for others while he is in good health. When he begins to cough and sneeze he not only spreads abroad the virus that has given him a cold but, at the same time, spatters about a spray which may contain pneumococci, meningococci, etc. Not only may he directly infect susceptible contacts, but he will, at the same time, start a circuit of new carriers who, in their turn, will take up the distribution. The increase of carriers of all kinds during the wet and cold months is most probably dependent upon just this sequence of events. It has surprised us on a number of occasions (with the astonishment that comes to workers in this field whenever a theoretical deduction is confirmed by practical results) that the general sick rate of a troop unit can be reduced in a very short time when rigid attention is given to the prevention of simple colds.

The cold thus assumes a significance far greater than the mere propagation of other similar cases. In a group of fifty men or women there are more likely to be two or three that harbor meningococci, a similar number that may harbor virulent pneumococci, streptococci, or diphtheria bacilli. Let any of these begin to cough and sneeze, and other individuals, perhaps themselves immune, will begin to " carry " these bacteria, especially if at the same time they acquire the cold by which their nasopharyngeal mucous membranes are converted into a particularly favorable nidus for the new invaders. During an epidemic of respiratory infections which we had occasion to study in 1907 (8) and during which a large number of pneumonias occurred, most of the men acquired severe colds. The conditions were such that by coughing, spitting, and sneezing a free distribution of organisms from man to man was to be expected. We examined twenty-five men from a company in which a number of pneumonia cases had occurred but who were perfectly well except for colds. Of these, 1 was a pneumococcus (type 1) carrier; 2 were pneumococcus (type 2, atypical) carriers; 1 was a pneumococcus (type 2) carrier; 2 were virulent streptococcus carriers; 1 was a streptococcus and influenza bacillus carrier.

More than one-fourth of this small group, therefore, had become carriers of organisms capable of causing respiratory diseases. Had we been in a position to extend this series, to examine also for meningococci and diphtheria bacilli, and to make a more systematic examination for influenza bacilli, the results might have been still more significant.

In the case of meningococci this fact has been noted several times, and Bassett-Smith (9), who examined some 27,000 men who entered the British Naval Service during the years 1916 and 1917, found the highest percentage of carriers in May, 1917, after an unusually cold April, and attributes this rise to the prevalence of catarrhs among the recruits during this time. We will have occasion to discuss these relations more extensively in the section on meningitis.

In the case of diphtheria, too, Moss (10) and others have noted increased carrier rate of diphtheria bacilli in school children during the wet and cold months, and we ourselves have seen a machine gun company with a diphtheria carrier rate of over 10 per cent. under conditions of crowding when catarrhal naso-pharyngitis was prevalent.

It is not difficult to demonstrate, there-

fore, the importance of preventing an epidemic of colds. It is not so easy to point out a method of achieving this result. The individual gravity of these cases is usually so slight that neither the physician nor the public can be persuaded to follow conscientiously directions which seem out of proportion to the seriousness of the immediate consequences. Ordinarily, the strongest ally of public health procedure is terror. It is a simple matter to enforce vaccination when a case of smallpox has appeared. The measures aimed at the prevention of any grave malady appeal to the public imagination. The often onerous details that, taken together, would reduce the incidence of colds, are more difficult to enforce. Nevertheless, the attempt should be made.

Were the writer in charge of any community unit in which severe colds were beginning to appear and isolated cases of true influenza were developing, he would immediately attempt to institute the following procedure, in addition to the general respiratory precautions already outlined.

Information should be conveyed to the workers either by conference or by a mimeographed circular, describing the infectiousness of the cold, its secondary dangers, and mode of conveyance.

The use of paper handkerchiefs and paper bags for soiled ones, placed near the worker's place, should be instituted.

Those actively sneezing and coughing should be excused from work or isolated in special parts of the room, and on these people temperatures should be taken. If a temperature of 100° or over were found, the patient should be hospitalized or excluded from common work rooms and mess whenever possible. If such individuals are sent home they should be warned against family contact. We believe that when persons with severe colds are living at home, local treatment such as periodical argyrol instillations are of some value in preventing distribution to others.

All the general protective measures concerning respiratory disease, as described above, should be rigidly enforced and supervised, and the necessary attempt should be made to persuade the workers to extend this system for the protection of their homes.

Influenza

As a clinical term, the conception of influenza has been much confused. In the past it has been applied to anything from a severe cold in the head to atypical bronchopneumonias. The study of epidemics, however, such as the pandemic of the nineties and the various outbreaks which have taken place during the war, has helped us somewhat in clinically defining this condition. We ourselves have had occasion to study a number of the early outbreaks of influenza which occurred in France among the American Expeditionary Forces, and from these observations, as well as from similar studies made upon the troops in the United States by Vaughan (11) and others (12), are convinced that this disease, in its pure form, need not primarily be associated with respiratory symptoms. Influenza, as it appears in the warm weather of early spring or late summer, at seasons when the general respiratory health of the community is apt to be good, shows no catarrhal manifestations of nose, throat, or lungs. The first group of cases seen by us in a military community at General Headquarters in France comprised over 300 cases. The disease assumed a form precisely similar to that which was described for some of the earlier epidemics in America. These cases were clinically very uniform, as follows: There was a sudden onset, the time of first symptoms often being determinable by the exact hour. Patients at a given time of the day or in the middle of the night would, without previous warning, suddenly be seized with a severe headache, pain in the back, limbs, chilliness, and, if the attack occurred in the daytime, vertigo and often nausea were noticed. Temperatures at this stage varied from 100° to 103°, but physical examinations were entirely negative. Except for occasional mild sore throats, these early cases showed no focus from which cultures were indicated. The leucocytes were depressed or normal, with usually a relative lymphocytosis. There were no enlargements of spleen or lymph nodes. The temperature would subside within three or four days, and no bronchial or pulmonary lesions developed. This was usually followed by an uneventful and rapid convalescence. Later, as the cold weather came on, similar outbreaks manifested more tendency to catarrhal respiratory symptoms. Sore throats were common, injection of the conjunctivae occurred, and mild bronchitis supervened. In these latter cases, influenza bacilli could often be

isolated from the throats. Later, in the cold weather, when men were exposed to crowding, to cold, and to wet weather, secondary infection of the respiratory organs followed and the simple character of the uncomplicated disease was completely obscured. The significance of such observations is that influenza, the pure and uncomplicated disease, is a systemic infection which is relatively mild and rarely, if ever, results fatally unless complicated by secondary infection. Of great sanitary importance, however, is the fact that such cases are excessively susceptible to secondary infection with pneumococci, streptococci and perhaps with meningococci. The secondary pneumonias which are so apt to follow may be caused by many different kinds of micro-organisms, the type of infection depending largely upon the bacteria which are most prevalent in the group. Thus, the pneumonias that accompanied influenza outbreaks sometimes showed a predominance of hemolytic streptococci or of the various types of pneumococci.

The etiology of the original influenza is a matter that is much in doubt. It is not possible at the present time to say with positiveness that the Pfeiffer bacillus is the cause of the disease, and it might well be that this organism is purely a secondary invader like the pneumococcus and streptococcus. However, as far as the studies that have recently been made can be summarized, the Pfeiffer bacillus must still be considered as the most likely cause of the infection. Claims have been made by the British that the disease is due to a filtrable virus, and extensive experimentation in this direction is in progress in a number of laboratories. In our own experience, cultures from throats of early cases that showed pharyngeal and bronchial inflammations have often yielded Pfeiffer bacilli, and this has been the experience of many other observers. The fact, too, that recent experiments by Parker (13) and by Huntoon and Hannum (14) have demonstrated the production of a toxin by this bacillus would explain the profound systemic manifestations that accompany a relatively mild local infection. For these and other reasons, we ourselves, at the present time, favor the view of the etiological responsibility of the Pfeiffer bacillus.

Mild in its uncomplicated form, the disease is a dangerous and fatal one in its consequences rather than in its inherent nature and, should suspicious cases appear in a group, the principal thing to remember is that they must be immediately hospitalized or at least put to bed under conditions of suitable isolation, such as those described for pneumonia. This has saved many lives by preventing secondary infection, and is one of the most important points insisted upon by clinicians like Harlow Brooks, Homer Swift, and others who have had extensive experience with epidemic forms of the disease.

The infectiousness of the disease is extreme. Epidemiological studies in France and elsewhere have shown definitely that, while the disease is easily transmitted from person to person, there are still other factors that lead to the sudden infection of a large number of people at about the same time. In the Chaumont epidemic, as well as in similar epidemics in the 42d Division studied by us, a large number of individuals in a given unit would come down suddenly within a very short time. In one company we remember that between sixty and seventy cases occurred within forty-eight hours. Such synchronous mass infection can be brought about by a limited number of factors only, either by ingestion of the infectious agent with food or by inhalation with dust. Investigations into food supply have proved uniformly negative, although there is a considerable possibility that some infections may be transmitted in dining halls and mess rooms through improperly cleansed eating utensils. It is also likely that a great many persons may be infected by dust, contaminated by the sputum of diseased individuals or carriers. On a number of occasions, the sudden appearance of many cases followed directly after troops had undertaken a long and dusty march.

The great infectiousness of the disease renders sanitary measures particularly difficult, and there is no reliable method of prevention that can be confidently recommended. The only measures that seem remotely hopeful consist in the rigid enforcement of the procedures outlined for respiratory infections in general and, in addition to this, insistence on careful inspection of the entire working personnel every morning. Individuals with headaches, pains in the back or legs, men who are suffering from obvious catarrhal infections of the mouth, nose, and throat, or who show conjunctival injection, should be

segregated and temperatures should be taken. All those with temperatures even slightly above normal should be put to bed under proper conditions for a few days. We believe that such measures could be successfully enforced in times of a general influenza epidemic. The general public is beginning to realize the seriousness of this disease when once it has gained headway, and education and insistence on rigid precautions even with the mildest cases will, we believe, be received with attention at such times. If early and mild cases could be promptly removed and segregated, a great deal might be accomplished in limiting the disease.

Measles

Not much need be said about measles since it is not a disease that is apt to assume epidemic dimensions in communities composed of the age-groups concerned in industrial occupations. However, this disease should not be completely neglected in our discussion since unusual circumstances might well bring about local outbreaks which, under conditions of faulty sanitation, could claim many victims. Like influenza, the disease is more to be feared for its secondary manifestations than for its dangers *per se*. In an epidemic which we studied at Camp Wheeler the mortality of measles pneumonias reached 29 per cent., whereas of the primary pneumonias 12.85 per cent. only died (8).

In protecting against the spread of measles, one particular procedure outweighs all other prophylactic measures. This consists in daily inspection of the entire group. A large number of persons can be efficiently scrutinized if directed to pass the inspecting officer in single file. A few questions are asked as to headache, appetite and sleep during the preceding night. Each individual is inspected for injection of the conjunctivae, redness of the throat, and for the presence of naso-pharyngeal catarrh. The skin of the chest and abdomen is rapidly looked at. Those that are in the slightest degree suspicious are asked to step aside until the inspection is over. On this group subsequent temperatures are taken. All those with temperatures over 99.5° are excused from work and placed under observation. The disease is most infectious during the very early stages before the rash has appeared, and by the time that a patient is sick enough to report of his own accord to the physician, the harm has been done.

The general measures as to cleanliness, etc., should, of course, also be observed. But we base our opinion on experience when we say that we believe that a measles epidemic can be arrested in its early stages if the daily or twice daily inspection is carried out skilfully and conscientiously.

Pneumonia

There are, of course, a large number of different forms of bacterial infection of the lungs which are classified together as pneumonia. In the following paragraphs we will confine ourselves to the discussion of pneumococcus infections, and since we are discussing industrial communities composed of healthy adults, we will deal primarily with the lobar forms of the disease. In the ordinary lives of peaceful communities, pneumonia rarely assumes epidemic dimensions. On occasion, however, it may become generalized; and of recent years it has been one of the most serious epidemic diseases that has occurred in army cantonments and camps. Indeed, wherever human beings live under conditions of crowding and exposure, especially during the cold and wet months of the year, the possibility of a pneumonia epidemic is created. Thus, there have been outbreaks recently in the mining districts of South Africa and in Panama, and there have been more serious ones in a number of our army camps. In the African and Panama epidemics, the disease attacked chiefly the negro workers. Outbreaks of pneumonia that assumed alarming epidemic proportions occurred in a very large number of both the barrack and the tent camps under conditions which have been carefully analyzed by Vaughan and Palmer (11), and it is stated by Soper (15) as accounting for 24,500 deaths, or 81.4 per cent. of all deaths in the army of the United States in 1918. The disease, therefore, presents definite epidemiologic possibilities. In times of peace, these will never be of such an appalling nature as they were in camps during the war, but we must always bear in mind the likelihood of smaller epidemic outbreaks in asylums, institutions, schools, labor camps and other industrial communities where a certain amount of crowding may often be unavoidable, and where

daily association of the same group of individuals is an occupational necessity.

The fact that pneumonia can be transmitted from person to person has long been suspected and Johannesen, years ago, separated by screens his pneumonia cases from other patients. This view, however, was an exceptional one until recent years, largely owing to the fact that pneumococci could be normally found in the mouths of many healthy individuals. Some years ago, we ourselves examined the mouths of several hundred healthy people and found pneumococci in something over 30 per cent. of those examined. Re-examined by the more perfect recent methods, these figures might probably be increased. In fact, the workers at the Rockefeller Institute * (16) have found pneumococci present in 116 out of 279 normal mouths examined. There was formerly a strong and, at that time, well-founded suspicion that many pneumonias might be the results of pulmonary auto-infection with the organisms normally present in the mouths of the patients. The entire field of pneumococcus investigation was, however, given a new direction when Neufeld and Haendel (17) discovered that by the use of highly potent sera produced with individual strains of pneumococcus, definite serological or antigenic groups could be differentiated. This observation was confirmed and very much extended by the workers at the Rockefeller Hospital whose classification of the pneumococci is now an established part of our knowledge of the group. This classification, as determined by agglutination reactions with specific sera, is shown in Table 1.

To make this chart entirely clear it is necessary to add that Type IV, unlike the others listed in the table, is not a homogeneous group, but represents a heterogeneous collection of pneumococci which do not agglutinate in the sera of the other types and have no fixed relationship to each other. Type IV is established merely as a matter of convenience, an attic into which all the heterogeneous groups can be stored until we can more definitely subdivide them. Many attempts have been made to subdivide Type IV into definitely recognizable sub-groups (18), but so far this has not been successful because investigation has always been forestalled by such extensive variation between the individual organisms obtained that no permanent classification could be adopted. The Type IV pneumococci are in the same condition as the so-called "streptococcus viridans" group, among which it is rather the exception to find serological homology between individual types. In addition to the types mentioned, there are undoubtedly other well-defined ones which future investigation will reveal. There are certain homogeneous groups found in South Africa and the Tropics that are as sharply homologous as Types I, II, and III, but which have not, up to the present time, been shown to occur in this country.

Though incomplete, this classification has already borne fruit in materially increasing our epidemiological knowledge of pneumonia. The workers at the Rockefeller Hospital, in analyzing the pneumonias occurring in New York City and vicinity, have found a distribution of types in lobar pneumonia as shown in Table 2.

Type determinations from mouths of normal persons, however, gave a different result, as shown in Table 3.

TABLE 1. — DETERMINATION OF PNEUMOCOCCUS TYPES BY AGGLUTINATION †

Pneumococcus Suspension, 0.5 c.c.	Serum I (1 : 20) 0.5 c.c.	Serum II (Undiluted) 0.5 c.c.	Serum II (1 : 20) 0.5 c.c.	Serum III (1 : 5) 0.5 c.c.
Type I	++	−	−	−
Type II	−	++	++	−
Sub-groups IIa, b, x	−	+	−	−
Type III	−	−	−	++
Type IV	−	−	−	−

Incubation for 1 hour at 37° C.

TABLE 2. — INCIDENCE OF TYPES OF PNEUMOCOCCUS IN LOBAR PNEUMONIA ‡

Type of Pneumococcus	Incidence	
	No. Cases	Per Cent.
I	151	33.3
II	133	29.3
IIa	6	1.3
IIb	4	0.9
IIx	9	2.0
III	59	13.0
IV	92	20.3

* The pneumonia question has been thoroughly dealt with in a recent monograph of the Rockefeller Institute by Avery, Chickering, Cole, and Dochez, No. 7, Oct. 16, 1917.

† This table was taken from Avery, Chickering, Cole, and Dochez, loc. cit., p. 25.

‡ Loc. cit.

The striking feature of these tables is the fact that more than 50 per cent. of the organisms obtained from normal mouths belong to the heterogeneous group spoken of as Type IV, whereas the majority of lobar pneumonias (almost 80 per cent.) showed organisms of the more homogeneous types. It may be concluded from this work, therefore, that pneumonia is in most cases caused by organisms that are not present in normal mouths. If the tables are further analyzed they show that only 0.8 per cent. of normal persons showed Types I and II, whereas these organisms were responsible for 62.6 per cent. of the pneumonias. From this it would seem obvious that most cases of lobar pneumonia acquire their infections from extraneous sources and cannot be regarded as auto-infections. It must not be concluded, however, that Type IV is entirely without importance in the causation of the disease. Recent analyses, especially some of those made during the war, would tend to show that Type IV may, under certain circumstances, be very virulent and frequent as an etiological factor. It is even claimed by some workers at the present time, though we do not believe their opinions sufficiently founded on reliable evidence, that Type IV organisms seem to be becoming more frequent as causative factors and are showing relatively more virulence than they did when the earlier observations were made.

TABLE 3. — DISTRIBUTION OF DIFFERENT TYPES OF PNEUMOCOCCUS IN MOUTHS OF NORMAL PERSONS *

Type of Pneumococcus	Incidence	
	No. Cases	Per Cent.
I	1	0.8
II	0	0.0
IIa	1	0.8
IIb	7	5.8
IIx	13	11.6
III	34	28.1
IV	64	52.9
Pneumococcus present	116	
Pneumococcus absent	181	
	297	

Furthermore, observations by the Rockefeller Hospital investigators have indicated that the virulent types of pneumococci usually disappear from the mouths of convalescents within three to four weeks, often earlier, and are supplanted by the less virulent Type IV strains. This, too, would tend to show that the first three types were specifically related to the infection of the lungs, whereas Type IV is to be regarded as a relatively saprophytic variety. Interesting information from the epidemiological point of view has been gained from the study of the types of pneumococci found in the mouths of contacts, and Stillman (4) showed that individuals associated with pneumonia patients may frequently harbor organisms of the same type as those infecting the patients. His studies also revealed that the dust in rooms inhabited by such patients may contain virulent pneumococci corresponding in type to those causing the pneumonias.

All these observations represent a reasonable foundation for the supposition that pneumonia may be regarded, to a considerable extent, as an infectious disease which is spread by patients and carriers of virulent types of pneumococci, and in this respect is comparable to other infectious conditions. The older idea, that any individual harboring pneumococci of any type in his mouth may become subject to auto-infection when exposed to cold and wet, is rendered increasingly less probable, and we must conclude that the acquisition of a virulent pneumococcus from an extraneous source, either directly from a patient or a carrier or indirectly through sputum or dust, is a necessary premise for the occurrence of the disease.

With the above knowledge at our disposal, it goes without saying that our attitude toward the sanitary control of pneumonia must be changed materially. We must now recognize that in this disease, as in many others, precautions must be taken to segregate patients and to prevent the promiscuous transmission of sputum as in sneezing, coughing, spitting, etc., among individuals of an indoor group.

There is, however, another factor in the sanitary control of pneumonia which is of as great importance as (in our opinion of greater importance than) the mere prevention of transmission of infectious material. To elucidate exactly what we mean, it will be necessary to digress briefly. In all communicable disease two dominant factors are concerned in the infection of one individual by another. The first of these is the *transmission* of the infectious agent by proper routes and in sufficient dose.

* Loc. cit.

The other is the *susceptibility* factor of the newly invaded host. In many conditions such as smallpox, measles, scarlatina, plague, glanders, etc., and to a lesser extent in such diseases as cholera, typhoid fever and influenza, the *susceptibility* of the normal, previously unexposed human being is so high that few will escape infection if for the first time brought into contact with a sufficient dose of the virulent causative agent under proper conditions. Here the effort of the sanitarian must concentrate chiefly upon the prevention of dissemination of the infectious material, and, in addition to this, he must seek methods to increase the specific resistance of the population as a whole, such, for instance, as smallpox vaccination and typhoid inoculation.

There are other infections, however, among which we place pneumonia and meningitis, in which the resistance of human beings as a class is relatively high. In pneumonia, as in meningitis, the virulent organisms may gain access to the upper respiratory passages of a large number of normal human beings without giving rise to disease. For the development of pulmonary infection a coincidence of two accidents is necessary. One is the acquisition of a virulent pneumococcus by direct or indirect contact, the other is the development of a subnormal resistance due to faulty hygiene. Both factors are necessary, and the chances of their co-existence are great, since an acquired Type I, II, or III pneumococcus may remain in the victim's mouth and throat for prolonged periods; and depressed resistance may be a condition persisting for weeks in environments such as army cantonments or labor camps.

In this latter class of conditions, therefore, while proper precautions against the dissemination of the infectious agents must be taken, the efforts of the sanitarian should concentrate particularly upon the hygienic measures which will, as perfectly as possible, maintain normal resistance.

In both classes, the two dominant factors must be considered, but while in the former the accentuation of sanitary effort must be placed on the transmission factor, in the second group general hygienic control and the maintenance of resistance must be particularly emphasized.

In pneumonia epidemics such as those occurring in some of the military camps, it was quite plain that the susceptibility factor was the determinative one in the incidence of individual infections. Tent-to-tent survey frequently showed that while several cases came from the same tent, often the infections were of different types. The men had been exposed to the promiscuous distribution of sputum, but at the same time had been uniformly subjected to cold, wet, and the unaccustomed work of early military training. Direct transmission from case to case could often be established on a circumstantial basis, but in only a few cases at a certain camp, in which extensive studies were made, were separate cases in the same tent associated with a single type. In this camp there was a regiment of engineers which was on a certain day exposed to unusually difficult weather conditions, incident to a march during a heavy rain with subsequent camping on wet ground. In this regiment twenty-six pneumonias occurred within 16 days. These were analyzed as follows:

In company A which had 7 cases, 4 were Type I.
In company B which had 6 cases, 4 were Type I, and 1 was Type II.
In company C which had 5 cases, 3 were Type IV.
In company E which had 7 cases, 4 were Type I, and 3 were Type II.
In company F which had 6 cases, 3 were Type II, and 2 were Type I.

In one of the companies of this regiment in which cases had occurred, twenty-five men who were healthy, except for colds in the head, were examined to determine whether or not carriers of virulent organisms had developed, and eight of the twenty-five were shown to be carrying virulent pneumococci or streptococci. These individuals did not come down with pneumonia. From evidence such as this, we conclude that, while of course the infectious agent must be transmitted, and attention to measures preventing this must not be relaxed, the more important phase of pneumonia prevention lies in protection against cold, exposure and wet, proper feeding and avoidance of overwork — in short, proper hygienic supervision. If, added to this, crowded sleeping is prevented and ventilation in quarters enforced, we are convinced that the lobar type of pneumonia will drop to a minimum.

When a case of pneumonia occurs, therefore, the sanitary control should proceed along two distinct lines, as follows:

The case should be segregated either at home or, preferably, in a hospital. The segregation need not be absolute, that is, in a separate isolation room, but the patient should be separated from other patients or from his family by screens of paper or of linen hung from strings or frames, so that sputum cannot contaminate others directly or indirectly. Nasal and bronchial secretions should be sterilized, and attendants should be advised to wear masks. When many cases are assembled in a hospital ward, the screening of cases should be a rule and the wearing of masks should be strongly recommended. This last precaution is not so much for the protection of the doctors and nurses themselves, but rather because of the possibility of their becoming carriers.

General prophylactic measures in the unit from which cases of pneumonia have been taken must again restrict themselves to the general measures advised for respiratory disease control in preceding paragraphs. Again, special importance should be attached to prevention of dust, temperature conditions, draughts, drying rooms for clothing, and the changing of wet underwear before exit into the cold evening air in the case of individuals engaged in labor that causes them to perspire. The crowding of sleeping quarters is of particular importance, and special rounds of visits to the homes of workers with advice concerning this should be made. Dryness of shoes and socks, changes of socks during the day, etc. — in fact, all common sense measures for the prevention of mild catarrhal respiratory disease must be taken.

In the interest of future knowledge as well as of successful therapy, it is strongly advised that whenever laboratory service is available type determination should be made on the cases and, if possible, on the families of the patients and on working associates. This will not only be interesting for the individual problem, but information of this kind will contribute materially to future knowledge of pneumonia.

Prophylactic vaccination against pneumonia has been attempted. Inoculations on a large scale were tried by Wright (19) as early as 1911, but since this work was done before the importance of type determination had been discovered, its significance cannot be properly evaluated. Lister (20) more recently carried out prophylactic inoculation against various types of pneumococci among the workers in mines in South Africa. He used carefully typed cultures and injected as many as seven billion intravenously. His final procedure was to administer three subcutaneous doses of two billion of his Types A, B, and C (C and B corresponding to American Types I and II, respectively) at seven-day intervals. He reports a definite drop in morbidity and mortality rates among miners thus inoculated. His results are distinctly encouraging. In this country the only large experiment so far carried out is that of Cecil and Austin (21) in which 12,519 men were vaccinated at Camp Upton against Types I, II, and III. The results of this experiment, though encouraging, are inconclusive. During a ten-week period following the experiment no cases of pneumonias of Types I, II, and III (the organisms used in the inoculations) occurred among the vaccinated. But only twenty-six cases occurred among 20,000 controls during the same period. Furthermore, the incidence of pneumococcus IV and streptococcus pneumonias was less among vaccinated than among unvaccinated. Since the vaccine contained none of these organisms, this fact would incline us to believe that some other factors of general hygiene were in force among the unvaccinated which made them a more protected group than the controls. All that one can say about prophylactic vaccination against pneumonias is that its value is, so far, an unknown quantity, but that preliminary work has been encouraging and should lead to further study without too much delay. While it will probably never attain the sanitary importance of typhoid vaccination, owing to the rare occurrence of true pneumonia epidemics in civilian life, nevertheless, it might be of inestimable life-saving value at times of epidemic occurrence in labor camps and similar groups.

Meningitis

While infection of the meninges may be caused by a large number of different bacteria, there is only one form which is epidemiologically important. This is the disease spoken of as epidemic cerebrospinal meningitis, which is caused by the meningococcus and which may be transmitted from person to person with the discharges of the upper respiratory passages.

Epidemics of this condition have been

frequent in many different parts of the world during the last 150 years. And from the point of view from which we are discussing it in the present connection, it is important to note that, in the train of epidemic outbreaks, sporadic cases and small-group infections trail along for periods of years. In 1903, 1904, and 1905 there was a severe epidemic on the Eastern seaboard of the United States, centralizing particularly in New York where there were hundreds of cases. Following this, the disease extended to Canada and the Middle West and Western states, and since that time it has been more or less endemic throughout North America. During the war the first severe outbreak on the western front occurred among Canadian troops camped on Salisbury Plain, and remained, thereafter, a problem of considerable seriousness among allied troops, at least among those stationed in back areas and in mobilization camps at home. According to studies of Vaughan and Palmer (11), the highest morbidity rate in any camp in the United States occurred at Camp Jackson where it reached 25.7 per thousand, the death rate being 7.05. It was the most serious illness next to pneumonia that occurred in the army camps, chiefly because of its high mortality and because, as Vaughan states, "of all diseases meningitis showed the greatest excess over the disease in civilian communities." Vaughan estimates that meningitis was forty-five times as frequent in the army as in civilian life, a fact which is important in pointing out the serious effect upon meningitis rates of crowded living under conditions which favor catarrhal inflammations of the upper respiratory passages.

The meningococci leave the body of the case or carrier with the mucus of the naso-pharynx and upper respiratory passages, and enter the new host by the same route. Received into the naso-pharynx of the newly invaded individual, the organisms probably pass into the meninges, through the lymphatics, directly into the base of the skull. It is also possible, however, that they reach their final place of lodgment by way of the blood stream. The former route is probably the more frequent, although our knowledge on this particular point is still defective and subject to possible alteration. British writers in the early periods of the war called attention to the fact that cases of meningitis occurred in which the organisms could be isolated from the blood stream before the spinal fluid showed infection. A recent study by Herrick (22), made at Camp Jackson, has laid considerable stress upon this type of case, and this writer concluded that the disease may, in most instances, consist of a primary meningococcus sepsis, to which the meningitis is secondary. He claims that the diagnosis can be made in the pre-meningitic stage in at least 50 per cent. of the cases. This observation is of great importance, not only in indicating that the organisms gain access from the naso-pharynx to the blood before reaching the meninges, but also because it points to the great importance of early blood culture in clinically suspected cases and of intravenous as well as intraspinal treatment with serum.

However that may be, it seems that the organisms actually enter the new host through the naso-pharynx, where they lodge either on a normal mucosa or more likely find suitable lodgment upon a slightly inflamed soil. Indeed, Flügge (23), during the early years of carrier investigations, claimed that the meningococcus was associated in the throat of carriers with definite inflammatory reactions. This view, we think, cannot at the present time be maintained since many carriers may present perfectly normal mucous membranes.

As in other diseases, one must of course consider the actual case as an important source of distribution. However, it has been noted in a great many epidemics that doctors, nurses, and others in direct contact with cases do not very often contract the disease; and, furthermore, the patient is limited in his possibility of transmission to the few individuals taking care of him. The relative immunity of persons in direct contact with a patient has been noted again and again, not only in such epidemics as the one in New York City, where only a few doctors and nurses contracted the disease though they were, of all people in the community, the most frequently and directly exposed, but it has also been noted in British hospitals during the war. An editorial in the *British Medical Journal* of 1916 mentions a British hospital in which 161 cases were treated without any infections among the staff, although many carriers developed in the hospital personnel. This is a point to which we will return later, since it has considerable importance in the interpretation of epidemiological data.

Of much more epidemiological importance than the case, therefore, is the carrier. Carrier examinations were begun by Albrecht and Ghon (24), and since 1901 have been the subject of numerous investigations. The earliest researches must be largely discounted by the fact that nothing was known about the types of meningococcus, and the bacteriological diagnosis of the Gram-negative cocci obtained from throats was not reliable in the modern sense. Although observers like Ostermann (25), Kutscher (26), and others *did* make use of agglutination with immune sera for identification, they did not have polyvalent meningococcus sera at their disposal, and such enormous percentages of carriers as those found, for instance, by Ostermann, who discovered seventeen carriers (74 + per cent.) in a group of twenty-four individuals in a single family in which a case occurred, exceed our modern observations to such a degree that it seems likely that he may have included non-pathogenic species. The pitfall of meningococcus-carrier examinations is the fact that a great many of the Gram-negative cocci from the pharynx agglutinate spontaneously in normal horse serum. Insufficient attention to this is not an attribute of the earlier investigators alone.

The intensive study of the meningococcus-carrier problem during the war has given us much additional information, and the more recent work has been based on a careful definition of what can be regarded as true meningococcus. The method, at present practiced, consists in making smears from the posterior and upper parts of the pharynx upon carefully prepared and tested media, picking and staining suspected colonies, transplanting these and agglutinating them against polyvalent meningococcus serum, with suitable control against the possible error of spontaneous agglutination in horse serum. We omit the bacteriologically technical details as not pertinent to the subject of our present discussion. We may add, however, that although our bacteriological definition of meningococci is sufficiently sound for the determination of species relationship, there is still a serious gap in our epidemiological knowledge, owing to our inability to distinguish between virulent and avirulent strains of true meningococci. In the case of diphtheria, pneumonia, and some other diseases, we possess methods of telling the difference between an organism that is capable of inciting disease in the human being and one that is harmless or relatively so. We cannot tell, at the present time, whether or not an agglutinable Gram-negative diplococcus isolated from the naso-pharynx is capable of inciting meningitis. No constant differences between pharyngeal strains and spinal-fluid strains have so far been apparent, and until this defect in our knowledge is corrected we must necessarily infuse a certain amount of conjecture into our views concerning the epidemiology of the disease.*

Carrier examinations were made on a large scale during the war by the bacteriologists of all the allied forces. Of special importance are the intensive studies made by the British who established a central meningococcus laboratory under the directorship of Gordon (27). The figures obtained by English bacteriologists were, in a general way, identical with those obtained elsewhere, and have revealed a number of important statistical facts. Bassett-Smith (9) in examining 26,543 men of the Royal Navy found 4.7 per cent. positive in 1917, as against 2 per cent. in the preceding year. Tulloch (28), examining 10,000 men, obtained 324 Gram-negative diplococci of which 221 or 2.21 per cent. were true meningococci of various types. In this country, Mathers and Herrold (29) found 4.4 per cent. carriers among 15,257 men in the Great Lakes Naval Training Station, and of these 1.2 per cent. were chronic carriers. A frequent observation made by a number of writers is the fact that the carrier rate goes up during the cold months of the year and during the prevalence of catarrhs. Bassett-Smith found the highest incidence during May, following a cold

* It is not at all impossible, too, that we may not as yet include in our polyvalent sera all the strains which can cause meningitis. Until 1909 the meningococci were considered as a homogeneous group. In that year Dopter discovered that serum agglutination can differentiate the ordinary type meningococcus from others which he calls the parameningococcus, an organism which occurred frequently in the spinal fluid of cases. Classifications of virulent meningococci were then worked out by numerous investigators, and at present a number of different classifications have been adopted in different countries. Gordon has attempted to subdivide meningococci into four main classes, I, II, III, IV. Type I of the English classification corresponds to the parameningococcus of Dopter; and Type II, to what both the French and American Schools speak of as the normal meningococcus. Types III and IV include the various organisms which in the United States are spoken of as intermediates, but there are so many minor differences between individual organisms that polyvalent sera produced in horses by a large number of strains must be used for diagnosis.

April, during which there was a great deal of mild respiratory disease among the men.

In regard to the difference between various groups of men within a camp, the figures of Mathers and Herrold are interesting in that they show a definitely high carrier rate among individuals in contact with cases. As stated above, they examined 15,000 men of whom 3.6 per cent. were positive. A limited group of convalescents showed 38.2 per cent. positive. Hospital Corps men showed 13.5 per cent. positive; contacts showed 26.7 per cent. positive; non-contacts showed 4.4 per cent. positive. The chronic carriers, as previously noted, were 1.2 per cent., and in such persistent carriers pure cultures were often obtained. An extremely interesting series of studies on this problem are those of Glover (30) upon the influence of general

TABLE 4. — EFFECTS OF "SPACING OUT" ON "SEVERELY OVERCROWDED" BARRACK-ROOMS *

Unit	Date of First Swabbing	Percentage Carrier Rate before Spacing Out	Period Spaced Out Approximately	Date of Second Swabbing	Percentage Carrier Rate after Spacing Out
No. 1	Sept. 29	22.0	8 weeks	Dec. 6	2.0
No. 2	Oct. 2	28.0	6 weeks	Nov. 23	7.0
One room of No. 2	Oct. 2	38.5	6 weeks	Nov. 23	4.5
No. 4	Oct. 26	28.0	5 weeks	Nov. 30	4.5

sanitary measures, especially the spacing out of men in sleeping quarters, upon the carrier rate. In a unit in which meningitis was occurring and in which crowded conditions prevailed, Glover examined a barrack company repeatedly before and after careful spacing out of the men in sleeping quarters had been arranged. The table he constructed is given above as Table 4. It shows the most striking differences as a result of this simple preventive measure.

It is of course logical to expect that there should be a definite relationship between the rise of carriers in a community and the number of cases which come down with the disease. This relationship has, indeed, been determined in such studies as those of Meleney and Ray, who traced fourteen out of twenty-four cases to carriers, and found parallelism between cases and the rise of carriers. It has not, however, been universally possible to demonstrate such relationship. Frequently groups including large numbers of carriers have not developed cases. Such instances as those noted above in connection with hospital personnel, as well as studies by Short (31), are interesting in failing to show any parallelism between carrier rates and cases. We quote from Short's report on the outbreak at the United States Naval Training Station at Great Lakes, Illinois, as follows:

"It will be seen at once that although there was a sudden rise of cerebrospinal fever early in January there was no previous increase over the usual carrier index, which did not begin to rise until the middle of January, two weeks later; while the peak of the greatest case incidence, and the percentage of carriers continues high for several weeks after the case curve has begun to decline. The smaller rise in carriers and cases during December, 1917, is synchronous in the chart, but on plotting the daily figures the rise in carriers is found to come a week later. This relation cannot be demonstrated in the rise shown in October, 1918, owing to the lapse of several days during this period when no cultures were taken. On account of the time factor brought out by the comparison of these two curves, it is difficult to account for the new cases on a basis of an increase in carriers, and it seems more logical to assume that the carriers are the result rather than the cause of the epidemic. Strength is further added to this assumption by the fact that while the small number of known carriers who preceded the epidemic had been very carefully isolated, on January 28, 1918 (when the carrier incidence had nearly reached its height) the restrictions on carriers were largely removed and no attempt was made to isolate those subsequently discovered. In spite of the great prevalence of unrestricted carriers when just beyond the peak of the case curve, the epidemic continued to decline. Another instance of the comparative harmlessness of carriers may be noted in this connection. A carrier (C. R. F.) who had been in isolation for several months at this time was placed on duty in an office under ordinary conditions. Cultures were taken at regular intervals and were continued in all over a year. At no time could he have been discharged under the system of obtaining three successive negative cultures, and yet, in spite of his carrying this organism for a year without any especial precautions, no new cases of the disease developed among his associates, nor could any new cases be traced to this carrier."

The epidemiological data concerning the spread of meningitis, therefore, lack a great deal in clearness, and there is much that needs to be further studied before we can develop a complete and satisfactory method of handling the disease. However, we can even now formulate certain definite principles which will help us in properly

* Glover, loc. cit.

managing epidemic outbreaks. In our own opinion, the conditions are something as follows:

The meningitis carrier, like the typhoid and diphtheria carriers, represents a constant menace in civilian populations. The carrier rate is probably higher than 3 per cent. or 4 per cent., since studies that have been made must necessarily fall below the actual number. In making the examinations, swabs are taken from one part of the pharynx only; carriers in whom the organisms are lodged high up in the naso-pharynx or ethmoidal passages, and those with few meningococci present at the time of examination, may show nothing on the plates, or a very few colonies may easily be overlooked. During periods of cold and wet with general distribution of catarrhal infections of the respiratory passages, the carrier rate goes up. This rise is enhanced wherever crowded living quarters prevail, and where people work and sleep under conditions of bad ventilation and in close proximity to each other. Under such conditions it is only logical to suppose that the carriers increase in number. Why, on the other hand, we must ask ourselves, does the disease under such circumstances select isolated individuals instead of becoming generalized, and why do so many people in contact with cases escape infection, especially as we know that the carrier rate is particularly high among these contacts? The answer, we think, lies along lines of thought similar to those outlined in connection with pneumonia. There is a great difference between individuals in susceptibility to meningococcus infection. We think that experience and the figures available show that most human beings have a high resistance against meningococcus. The susceptibles in the community are relatively few. Unlike pneumonia, the resistance is not so intimately related to temporary physical condition, but rests upon something more specifically fundamental, perhaps congenital, perhaps acquired in youth by naso-pharyngeal infection with meningococci. At any rate, there are such differences. When we try to trace cases to a single carrier, we are often astonished by the fact that in a large group only one or two individuals who have been in contact contract the disease, and that many habitual associates of a man who comes down with the infection are not carriers. This is, perhaps, due to the fact that contact sufficient to infect an individual with meningococcus is not necessarily a habitual one or a very close one. A susceptible who may have been living habitually in a group of twenty or thirty people may get his infection accidentally in a street car, in a moving picture show, or in the passing brief association with someone who has no relationship whatever with his habitual group. It is this fundamental difference in susceptibility which we believe explains the irregularity of epidemiological studies. A marked difference in the virulence of meningococcus strains, depending, perhaps, on the length of time they have been leading a saprophytic existence on the mucous membrane of an insusceptible, may also play a rôle in this phenomenon. However, this is purely a matter of conjecture.

What probably happens in an epidemic in a limited group of individuals is that there are, from the beginning, a definite number of carriers and a definite number of susceptibles. When respiratory catarrhal conditions prevail, the organisms are spread, more carriers develop, and the opportunities for the infection of susceptibles increase in geometric ratio. The habitual contacts of a carrier may be insusceptible, but a susceptible may come into brief temporary contact with a carrier and get the disease. When susceptibles have been infected the epidemic subsides, and it is not impossible that this is the chief reason for the decline in epidemics in camps and communities to which no new members are admitted during the disease. Often we may have flattered ourselves that we had stopped the disease by segregation of the cases, when the fire had burned itself out because the combustible material was used up.

The question arises — what shall we do to prevent the spread of meningitis in a group in which one or several cases have appeared? The answer to this question will vary according to the nature of the group under consideration, its average age, its size, environment, and variety of occupation. If we are dealing with large military communities among which cases are scattered, we do not think it advisable to make complete carrier examinations. It is better there, we think, to use the British method of determining a carrier rate, that is, examining 50 or 100 individuals promiscuously chosen, in order to ascertain

whether the carriers are increasing to an alarming extent, and measuring the degree of drastic sanitary interference by the danger signal of the carrier percentage. If we were dealing with factory communities or schools of a size sufficiently limited to permit accurate, complete investigation, we believe that repeated and systematic carrier examinations should be made, and the carriers excluded from association with others.

Important as we judge such attention to carriers, more important still for the prevention of meningitis, we believe, is immediate attention to the improvement of sanitary conditions in relation to respiratory infection. When meningitis occurs in such a group we would immediately make physical inspection of all members of the group, and would segregate those sneezing and coughing, excusing them from work if necessary, advising them as to precautions in the families, and attempting in this way to prevent a generalization of catarrhal respiratory infections. The sleeping quarters of the personnel either in their homes or in dormitories should be carefully scrutinized, and advice given if enforcement in the homes is not possible. Ventilation, prevention of sleeping in the same bed, caution against spitting, coughing, and hawking should be strictly attended to. The temperature of the working space and the ventilation should be regulated, and provisions made so that no one works in wet clothing or shoes, or leaves the building in a perspiring condition without change of clothing or previous drying. In short, all the measures should be taken which will reduce the general respiratory sick rate in order to prevent the formation of a vicious circle by which the number of carriers is increased. In a battalion of infantry in which five cases of meningitis occurred within a short period, we found that the daily sick call from mild respiratory infection amounted to over 250 a day. Attention to the simple matters mentioned above, together with prevention of overwork, etc., reduced the sick call to something over twenty a day. Coincident with this, meningitis disappeared.

A difficult problem is that concerning the disposition of the carrier. Many attempts have been made to free carriers of their meningococci by antiseptics of various kinds. Dichlorimine-T, potassium permanganate, chlorine, etc., have been used — all of them without satisfactory result. The most promising method of treatment was that developed by Gordon, Flack, and Hines (27) who sprayed a 2 per cent. solution of zinc sulphate mixed with steam into chambers into which the carriers were led for seven or eight minutes at a time on successive days. It is doubtful, however, whether any of these procedures will be found reliable. In most cases general hygienic measures, life in the open air, prevention of catarrhal infection, and general establishment of health of the mucous membranes is the most satisfactory method of curing carriers. There will always be a certain number of cases in whom it is quite impossible, in spite of persistent treatment, to remove the organisms permanently. What we are to do in such cases, only further study can disclose.

Diphtheria

Diphtheria as an epidemic disease is a problem of relatively small importance among adults and would naturally play a rôle of less importance in connection with factory hygiene than it does in the sanitary problems of schools. Resistance against diphtheria can be measured with more or less accuracy by determination of the amount of antitoxin circulating in the blood, and numerous measurements have been made to ascertain the approximate immunity to diphtheria enjoyed by the average human being. In the blood of newborn infants there is usually a definite amount of antitoxin and this is generally sufficient to protect against the ordinary diphtheria infection up to the age of about one year. This antitoxic property is inherited from the mother, probably transmitted through the placenta, perhaps to some degree through the colostrum during the first days of lactation. This, however, is a problem that needs re-examination and is of no particular importance in this connection. From the age of one year at which the protective value of the blood serum is at its lowest ebb, there is a gradual increase of its antitoxic properties and it attains its maximum value in vigorous adult life. Measurements of antitoxin content in the blood of human beings at various ages such as those made by Hahn (32) and Schick (33) are given in Table 5. These figures represent averages, of course.

It must be remembered that there are

great differences, etc., between individuals, and it is not unlikely that in the same person there may be temporary fluctuations of antitoxic values. The fact remains, however, that in the problems of adult sanitation diphtheria as an epidemic disease is not as immediately important as it is in connection with the health supervision of children. Nevertheless, the disease occurs and, under conditions of crowding during the cold months of the year, may become an important problem of sanitation. In two particular divisions of the army in France extensive outbreaks of diphtheria occurred in which it took a long

TABLE 5. — ANTITOXIN CONTENT OF HUMAN BLOOD

	Age	Cases with Antitoxin Serum	Cases without Antitoxin Serum	Highest Antitoxin Value in 1 c.c.
Schick	Newborn	11	0	under 1.5 units
	0–1 year	1	3	0.11 unit
Hahn	2–10 years	7	5	1.00 unit
	11–20 years	8	9	0.75 unit
	21–30 years	9	5	2.5 units
	31–40 years	5	1	0.15 unit
	41–65 years	2	8	2.5 units

time to arrest the disease. It is probable that a similar situation could arise in connection with factory groups. It will be important, therefore, to consider some of the principles upon which protection against diphtheria is based. The source of diphtheria, apart from the case itself, may be either transmission by carriers or by food.

Food transmission is numerically less important than that by carriers. In the former the disease appears in explosive, circumscribed epidemics; in the latter it is sporadic and may originate in many different foci simultaneously. Among food products the most frequent source of transmission is milk (34). Milk epidemics have been reported and studied for a great many years. In all such cases the outbreak is of an explosive nature, suddenly affecting a considerable number of persons, and upon study it can be found that most of the people affected have taken milk from the same source. Neisser (35) studied an epidemic in Frankfurt in 1903 in which there were ninety-seven cases, mostly adults, traceable by reliable circumstantial evidence to milk. The organisms have been isolated from market milk by Bowhill (36), Eyre (37), Klein (38), Dean and Todd (39) and many others. Dean and Todd reported an epidemic in which they claimed to have obtained diphtheria bacilli from ulcers in the udders of cows and from the milk. The organisms were virulent for guinea pigs. They could not transmit diphtheria bacilli from udder to udder and concluded that the ulcers were primarily streptococcus infections, secondarily infected with diphtheria bacilli. Eyre showed that the organisms could proliferate in milk. Since 1895 there have been fifteen probable milk epidemics in the United States. In some cases, diphtheria has occurred at the dairy and in the milk shop among the personnel which handled the milk. There have been epidemics in Dorchester and Milton in which careful epidemiological studies have connected the outbreak with the milk supply without much possibility of doubt. Thus, whenever explosive outbreaks, affecting a considerable number of persons at one time, occur in a circumscribed community, milk, cream, and ice cream must be thought of and accordingly investigated.

Much more important than food, etc., from the point of view of general diphtheria prevention, are the unrecognized case and the carrier.

Simple sore throat, mild pharyngitis, and tonsillitis may frequently reveal, on bacteriological examination, the presence of diphtheria bacilli without the appearance of any of the characteristic clinical features of the disease. This is especially true of such epidemic outbreaks as those in the army which occurred among individuals of relatively high resistance, where the true diphtheria infection may be so rapidly overcome by the resistance of the patient that it is never recognized in its true character. We have noticed this not only in connection with army sanitation, but also in civilian practice among adults. In patients of this age-group also, diphtheria bacilli may be present when the dominating clinical picture of the throat is one of Vincent's angina or of streptococcus inflammation. One is often astonished to find diphtheria bacilli present in such throats when a clinical picture did not particularly suggest diphtheria, and when the condition yielded readily to non-specific treatment. It is, therefore, an important principle in the prevention of diphtheria to regard all but the very mildest cases of sore throat as

suspicious, at least to the degree of insisting upon cultures. The taking of cultures is such a simple matter and reliable results are obtained with so little difficulty that there is no excuse for omitting cultivation in sore throats of any severity.

More important for the actual spread of the disease, certainly of greater importance than other factors in endemic persistence, is the diphtheria carrier. This has been recognized for a long time. It is by no means necessary for an individual to have had diphtheria to become a carrier. In the work of Moss (10) and his associates, three only of forty-nine bacillus carriers gave histories of having had the disease, and it is also a fact that relatively few of the carriers develop the disease in the course of their carrier state. Both of these observations show that there may be no indication to point to an individual as a probable carrier except the discovery of epidemiological relationship to developing cases.

The existing number of carriers is a clear index to their importance. A tabulation of the work of various observers between the years 1895 and 1907 made by Goldberger and Williams (40) indicates that out of 200,132 non-exposed persons examined, 0.18 per cent. were carriers of virulent diphtheria bacilli. Later examinations made by Goldberger and Williams themselves, on some 4093 healthy people in the city of Detroit in 1914, showed 0.928 per cent. to harbor morphologically typical bacilli and 0.097 per cent. were carriers of virulent bacilli. Moss and Guthrie, in examinations made on 1217 public school children in Baltimore and 1290 individuals in the city at large, found eighty-nine positive cultures or 3.55 per cent. Of these only eighteen and a fraction per cent. were virulent. These figures are imposing when we calculate from them the probable number of carriers found in large cities. According to Moss and Guthrie's (10) results, calculated on the basis of 600,000 people in Baltimore at that time, there were probably 20,880 carriers of morphologically typical diphtheria bacilli in the city of Baltimore, and it is likely that this is below the actual number since these figures are based on single examinations.

The chances are, therefore, that in every group of individuals gathered together for industrial purposes there are a certain number of diphtheria carriers, some of whom may harbor virulent bacilli, and it is more than likely, as our experience in the army has shown, that under conditions of the extensive occurrence of coughs and colds the percentage is considerably increased. We remember one small epidemic in a machine gun battalion which we had an opportunity to study in France (we quote this from memory; the report is not immediately available at the present moment, but we feel fairly sure that we are quoting without great inaccuracy) in which seventeen diphtheria carriers were found in a unit of not over ninety men. In this company there was a very high rate of mild respiratory disease, coughs, colds and bronchitis. Two of the carriers in this unit were among the cooks, and the importance of the examination of the kitchen personnel for the diphtheria carrier state, as soon as cases occur in the groups eating at a common mess, is a matter that requires attention. While most carriers seem to give no history of diphtheria, we must not forget that convalescents from diphtheria may also harbor the bacilli for considerable periods. This is mentioned merely in passing since, of course, it is common practice to hold diphtheria cases until two or three successive negative cultures have been obtained, the first one taken not less than ten days after the first positive culture.

Although most diphtheria carriers yield rather easily to treatment there are, nevertheless, certain individuals who may be designated as chronic carriers in whom bacilli will survive for months and even years in spite of the most vigorous efforts to dislodge them. Therefore, if in the course of the preventive measures outlined below a carrier should be discovered, it is necessary to remember that prolonged observation of this individual with perhaps segregation may become necessary, and that repeated cultures, both from the nose and pharynx, should be practiced before the case is dismissed from observation. Based on these considerations, the management of a group of workers among whom diphtheria occurred would be a relatively simple matter, and spread of the disease can be easily prevented if the necessary steps are taken with speed and energy.

On the occurrence of a case either in a worker or in a member of a worker's family, immediate attempt should be made to trace the possible origin. If contact with a recent case or convalescent can be established, the task is rendered relatively simple, and if the

circumstances seem to be sufficiently clear it may not be necessary to proceed farther. As a rule, however, this will not be possible. In that case, it is not unlikely that the disease may have been picked up from a carrier in the plant, though it will be quite impossible to trace all contacts of the diseased individual, since much of his exposure during weeks preceding the onset of the disease may have taken place in public vehicles or places of amusement. A series of throat cultures taken from his working associates, the members of his family, and if there is a common mess from the kitchen personnel, will settle this matter within a few days. It should be borne in mind that cultures must be taken not only from the pharynx and throat, but from each individual a nasal culture should be taken at the same time. If a carrier is found, it is necessary to determine whether or not the organisms found in the carrier are virulent. This the laboratory can easily determine by isolation of the bacilli and guinea-pig inoculation (41).* Should the organisms from the carrier prove to be virulent, immediate isolation will remove this particular source of infection.

It is questionable whether it is wise to go further than this in adult industrial establishments in which the measures adopted must be taken with the consent of the workers. Probably it would be better to do nothing further than to insist generally upon the rigid observance of established sanitary regulations. But should more cases occur and the situation take on the appearance of an epidemic, a more energetic procedure would be indicated. In addition to the taking of cultures the Schick reaction (42) † should be carried out upon all possible contacts. The reaction is easily carried out, and will show within forty-eight hours which are the susceptible members of the group. All individuals showing a positive Schick reaction should receive a prophylactic injection of from 500 to 1000 units of diphtheria antitoxin.

The problem again arises as to the disposition which should be made of chronic carriers. Most of these will clear up spontaneously as complete health of the upper respiratory passages is established. Mild alkaline or saline solutions may help. Antiseptic treatment has been unsuccessful as a general thing, and it is not impossible that drastic treatment such as that with iodine and weak formaldehyde will do more harm than good. Implantation on the throat with staphylococcus aureus cultures, recommended by German experimenters and also by Ravenel (43), has not had sufficient application to be carried out, and might under certain circumstances prove a dangerous procedure. Perhaps the most important method of treatment of such carriers is the correction of abnormal conditions of nose and throat with especial attention to naso-pharyngeal septa and removal of hypertrophied tonsils and adenoids.

A method of immunization against diphtheria has recently been worked out in which over-neutralized mixtures of toxin and antitoxin have been injected (44). The mixtures are made of about 85 per cent. of an L + dose of toxin per unit of antitoxin, and about 1 c.c. is injected at a time. Three such injections, according to Park and Zingher (45), at intervals of six or seven days will slowly develop antitoxin and produce an active immunization which lasts much longer than that obtained by simple prophylactic antitoxin injections. It is probable that this method will be extensively needed in the future.

* *Virulence Test.* — Two c.c. of 28-hour broth culture is injected into a normal guinea pig; a similar control injection is made into a guinea pig of 250 units of antitoxin. A more economic method consists in injecting intracutaneously 0.15 c.c. of a diphtheria salt solution into a guinea pig, making similar injection into a previously immunized guinea pig, reading the result according to whether a necrotic lesion forms in the unprotected pig. By this method four or five cultures can be tested on two pigs.

† *Schick Reaction.* — The Schick reaction is a test, the purpose of which is to determine whether an individual is protected against diphtheria by the antitoxin normally circulating in his blood. A standardized diphtheria toxin in salt solution is 0.1 c.c. of solution containing 1/50 M.L.D. This amount is injected gradually into the subject on the skin of the upper arm. A control injection of 1/50 M.L.D. of the toxin heated to 80° C. for five minutes should be made at the same time in order to control the Sudo reaction due to the protein contained in the broth in which the diphtheria bacilli have been grown. A positive reaction, which indicates that the blood contains 1/30 of a unit per c.c., shows within 24 hours a slight marking of the skin in the form of a red halo, 1 to 2 c.c. in diameter. This may not appear until 48 hours, and subsides very gradually. Individuals with negative Schick reactions are usually protected sufficiently to dispense with prophylactic antitoxin injection.

(*To be continued*)

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BOOKS RECEIVED

Books received are acknowledged in this column, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Towards Racial Health. A Handbook for Parents, Teachers, and Social Workers on the Training of Boys and Girls. By Norah H. March, B.Sc., M.R.San.I. With a Foreword by J. Arthur Thompson, M.A., LL.D., Professor of Natural History in the University of Aberdeen, and an Introduction by Evangeline W. Young, M.D. Cloth. Pp. 246 and appendices. New York: E. P. Dutton & Company, 1919.

Textbook of Meat Hygiene. With Special Consideration of Antemortem and Postmortem Inspection of Food-Producing Animals. By Richard Edelmann, Ph.D., Medical Counsellor; Royal State Veterinarian of Saxony; Professor at the Royal Veterinary High School in Dresden. Fourth revised edition by John R. Mohler, A.M., V.M.D., Chief, U. S. Bureau of Animal Industry, and Adolph Eichhorn, D.V.S., Director, Veterinary Department, Lederle Antitoxin Laboratories; Formerly Chief, Pathological Division, U. S. Bureau of Animal Industry. Cloth. Pp. 472 with index. Illustrations. Philadelphia: Lea & Febiger, 1919.

Pellagra. By H. F. Harris, M.D., Atlanta, 1919. Cloth. Pp. 421 with appendix, bibliography and index. Illustrations. New York: The Macmillan Company, 1919.

BOOK REVIEWS

Industrial Medicine and Surgery. By Harry E. Mock, B.S., M.D., F.A.C.S., Assistant Professor of Industrial Medicine and Surgery at Rush Medical College; Attending Surgeon, St. Luke's Hospital; Visiting Surgeon to Washington Boulevard Hospital; Chief Surgeon to Sears, Roebuck and Company; Fellow Institute of Medicine, Chicago; Lieutenant-Colonel, Medical Corps, U. S. A. Pp. 846, with bibliography, index and illustrations. Philadelphia: W. B. Saunders Company, 1919.

Physicians in industry will all be interested in Lieutenant-Colonel Harry E. Mock's recent textbook, *Industrial Medicine and Surgery*. Colonel Mock has treated the subject from every possible angle and has availed himself of every source of information obtainable. His position in Washington gave him the opportunity to acquire information upon reconstruction and similar subjects which could not be obtained elsewhere, while he has not hesitated to draw upon those best qualified to contribute chapters on special subjects.

Doctor Mock has considered his subject from the broadest angle, considering carefully many of the service problems which are being so freely discussed today. The book abounds in detail and will prove a very valuable guide to those just entering the practice of industrial medicine and surgery. Certain chapters should be carefully read by employment managers, safety engineers, and others interested in the question of personnel.

The book is divided into six parts. The first upon industrial health service covers health supervision with its fundamental ideas, the type and equipment of plant hospitals; the selection of a medical staff with a description of its duties; the duties of the nurse in industry; the advantage of an employees' dental service, and finally an illustration of the running of an industrial medical department taken from a factory maintaining such a system. The division continues with a discussion on the cost of the medical department, the supervision of the health of the managerial staff and the important part taken by recreation and exercise in the supervision of the health of employees. The division closes with a discussion of food, records, and the industrial health service.

The second part is given over to prevention. In this division are discussed such problems as preventive medicine and preventive surgery in industries, industrial hygiene, general and specific problems, health hazards, the National Safety Council, and accident prevention.

The third part deals entirely with the problems of industrial medicine. It considers the medical examination of employees and applicants for work, examination and correction of eye conditions, and the medical treatment of employees. Special chapters are devoted to women in industry and the tuberculous employee.

The fourth part is devoted to industrial surgery and covers the subject thoroughly.

The fifth part considers compensation insurance and medico-legal phases, while the sixth part is given over to reconstruction.

The special chapters put in concrete workable form the answers to many of the problems which are being considered daily by industrial physicians and surgeons, and the book will probably become established as the standard textbook of industrial medicine and surgery in America. — *W. Irving Clark.*

Human Infection Carriers. Their Significance, Recognition and Management. By Charles E. Simon, B.A., M.D., Professor of Clinical Pathology in the University of Maryland School of Medicine and the College of Physicians and Surgeons, Baltimore, Maryland. Cloth. Pp. 245 and index. Philadelphia: Lea & Febiger, 1919.

Of the many valuable contributions to our peacetime life which have crystallized from our experiences in the late war, one of the important ones is the concentration of attention upon the menace of human disseminators of disease. We have appreciated for a comparatively long time what mischief may be wrought by healthy carriers of typhoid and dysentery infections, but the recent epidemiological investigations in our army hospitals have done much to extend our knowledge of the far more widespread and deadly effects of the respiratory disease carriers.

Human Infection Carriers is the outcome of a request of the Surgeon General that medical students be thoroughly drilled in the epidemiological aspects of infectious diseases, including the laboratory phase of the question. Though primarily written for the medical student, it should prove a valuable guide and reference to the epidemiologist and health officer.

The carrier problem is considered only in connection with those diseases due to bacteria or filterable virus, in the dissemination of which healthy human carriers are known to play a rôle. This limitation in scope does much for the clearness in discussion of the following: cholera, diphtheria, typhoid and paratyphoid fevers, dysentery, epidemic meningitis, poliomyelitis, pneumococcus pneumonia, streptococcus infections (like camp septicemia, broncho-pneumonia, septic sore throat, erysipelas and puerperal fever), influenza and pneumonic plague.

Under each disease-heading are discussed: the occurrence of active and passive carriers, the duration of the carrier state, the frequency of carriers, the habitat and virulence of the causative organism, the mode of infection, the recognition of the carrier with a detailed description of the laboratory methods involved, and the management of the carrier from the standpoint of the public health officer. Concrete examples are offered illustrating the menace of the carrier to others. An appendix is included containing the most important state laws, municipal ordinances, and federal interstate regulations dealing with the carrier problem which have been enacted up to the beginning of 1918.

The treatment of the various subjects under dis-

cussion is clear and to the point, and frequent references to recent literature will be of aid to the student. The author has wisely refrained from extended discussion of matter that has not been clearly proven or is imperfectly understood. Occasional typographical errors, apparently unavoidable in first editions, serve to mar the good impression gained, and cause one to wonder if the statistical figures quoted are not also affected in a like manner. — *Barnett Cohen.*

Labour in the Commonwealth. By G. D. H. Cole. Cloth. Pp. 223. London: Headley Bros. Publishers, Ltd., 1918.

The theme of this book is the welfare of the worker, employing the term welfare in a wide sense. Its standpoint is that of the guild socialist; its attitude is ethical; its logic is political; and its temper is revolutionary — although some of these terms need further specification. The workingman's rights have been denied him, and from this infringement upon the fundamental good, i. e., freedom, much else has followed. The industrial revolution is based upon the idea of servitude, and all economic thinking has been dominated by that idea. It has always treated labor as an elementary commodity, and the harm done thereby will never be remedied until the point of view changes to the psychological, and the human being becomes the unit of calculation. The cure consists of the securing, on the part of the laboring class, of its rights; its right to self-determination and to control its own products is a primary good beyond argument — a good in itself to be obtained without any hesitation as to consequences. The means to that end are necessarily in some sense radical, and they are political. That, in a word, is the substance of the book.

It is the relation of this view of labor to specific practical problems that is of most interest to the student of industrial conditions; and it is worth while to observe that these political doctrines tend to antagonize a number of scientific recommendations, especially sociological conclusions, that are widely accepted. Most of the current projects for "reform" and "betterment" are in fact rejected. Lord Leverhulme's panacea of the six-hour day, for example, fails to appeal to the writer because the leisure of which it speaks is nothing but a "rest-pause" to fit the laborer to do better the work of the factory. Joint control of industries by the capitalist and the worker is a half-measure, and retains the class differences that are at the root of the whole trouble. Insurance projects are paternalistic, if not impertinent. The new Education Bill, by which the education of all workers is to be continued to the age of eighteen on a part-time plan, seems to the author to offer too many chances of playing into the hands of the exploiter, and to afford opportunity to separate still further the worker from the owner by making this supplementary education merely a fitting for trade. The educational thinker is the worst of all to contend with because of the apparent truth of what he says.

The real truth is that the great educational need of the masses is equality of education with the other classes. What the worker needs is not education to fit him for a better social and economic position, but the education which comes through opportunity to be self-determining, and in the exercise of rights and powers. Slow processes, whether educational or of any other kind, fail, and in great measure because of the automatic process by which, continually, a large part of the better stock of the laboring class is drafted out and affiliated with the employer class. The change, therefore, if it is to be a change for the better, must be radical. The democratization of industry and of government must be based upon a conception of classes and activities as functional. Trade unionism must reach more and more the expert, the foreman, and the professional worker. The control of industries must not be dual, but completely unified as guild control; and to make this complete, nothing less than a change in the whole principle of representation in government must be made.

The writer's plan, as contrasted with the scheme outlined by Benn and with the Whitley Report, would provide for a more "functional" and more direct control through a double parliamentary plan which, instead of being geographical and representative of the interests of individuals in the present political manner, would express the interests of all "users" in one body and of all "producers" in another, the two parliamentary functions combining only when joint interests were involved. In other words industry would become an independent function, self-determining, working out its own laws and its own plan of education. The attitude of this book, its "politicalism," as contrasted with what might be called the "educationalism" of the scientific point of view, is well indicated by the words with which the writer closes his chapter on Labour and Education: "Oscar Wilde once remarked that all art was absolutely useless. We might do worse than say that all education is absolutely useless. Neither remark is true, but both are inspired lies." — *G. E. Partridge.*